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ABSTRACT

This packet of 70 learning modules on alarm basics is 1 of 8 such packets developed for apprenticeship training for low voltage alarm. Introductory materials are a complete listing of all available modules and a supplementary reference list. Each module contains some or all of these components: goal, performance indicators, study guide (a check list of steps the student should complete), a vocabulary list, an introduction information sheets, assignment sheets, job sheet, self-assessment, self-assessment answers, post-assessment, instructor post-assessment answers, and a list of supplementary references. Supplementary reference material may be provided. The 70 training modules cover theory of diodes, bi-polar devices, and integrated circuits; binary numbering systems; logic gates; dialers; blueprint reading; building materials and symbols; design of alarm systems; types and applications of alarm systems; hand and power tools; types and applications of detectors; trade terms; types and applications of sensors; annunciators; detection devices; contacts; key stations; red tape procedures; builder board requirements; licensing; central stations; fire and police department monitoring; fire, police, emergency responses; card key and vehicular access control; business letters; video surveillance systems; and closed circuit television. (YLB)

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APPRENTICESHIP

LOW VOLTAGE ALARM

RELATED TRAINING MODULES

7.1 - 26.10 ALARM BASICS

CE 040 966

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APPRENTICESHIP

LOW VOLTAGE ALARM
RELATED TRAINING MODULES

0.1 History of Alarms

TRADE MATH

1.1 Linear - Measurement
1.2 Whole Numbers
1.3 Addition and Subtraction of Common Fractions and Mixed Numbers
1.4 Multiplication and Division of Common Fractions and Mixed Numbers
1.5 Compound Numbers
1.6 Percent
1.7 Mathematical Formulas
1.8 Ratio and Proportion
1.9 Perimeters, Areas and Volumes
1.10 Circumference and Area of Circles
1.11 Areas of Planes, Figures, and Volumes of Solid Figures
1.12 Graphs
1.13 Basic Trigonometry
1.14 Metrics

ELECTRICITY/ELECTRONICS

2.1 Basics of Energy
2.2 Atomic Theory
2.3 Electrical Conduction
2.4 Basics of Direct Current
2.5 Introduction to Circuits
2.6 Reading Scales
2.7 Using a V.O.M.
2.8 OHM'S Law
2.9 Power and Watt's Law
2.10 Kirchoff's Current Law
2.11 Kirchoff's Voltage Law
2.12 Series Resistive Circuits
2.13 Parallel Resistive Circuits
2.14 Series - Parallel Resistive Circuits
2.15 Switches and Relays
2.16 Basics of Alternating Currents
2.17 Magnetism
3.1 Electrical Symbols
3.2 Circuit Diagrams and Schematis
3.3 Schematics and Alarm Design
4.1 Solid State Power Supply System
4.2 Charging Circuits
4.3 Selecting the Power Size of Power Supply
4.4 Fuse and Circuit Breaker Protection
4.5 Battery Standby Capacity
4.6 Batteries
5.1 Troubleshooting - Electrical Tracing
5.2 Troubleshooting - Environmental Factors
5.3 Documentation of Design

SAFETY

6.1 General Safety
6.2 Hand Tool Safety
6.3 Power Tool Safety
6.4 Fire Safety
6.5 Hygiene Safety
6.6 Safety and Electricity

ALARM BASICS

7.1 Theory of Diodes
7.2 Theory of Bi-polar Devices
7.3 Theory of Integrated Circuits
8.1 Binary Numbering Systems
8.2 Logic Gates
8.3 Dialers
9.1 Blueprint Reading, Building Materials and Symbols
9.2 Design of Alarm Systems
10.1 Types and Applications of Alarm Systems
10.2 Burglar Systems
10.3 Fire Alarms
10.4 Hold-up Alarm Systems
10.5 Bank Alarm Systems
10.6 Wireless Alarm Systems
11.1 Hand and Power Tools
11.2 Maintain Hand and Power Tools
11.3 Safety Practices
12.1 Photoelectric Space Detectors
12.2 Passive Infrared Motion Detectors
12.3 Microwave Detectors (Radar)
12.4 Stress Detectors in Space and Volumetric Applications
12.5 Capacitance Detectors
12.6 Sound Discrimination
12.7 Ultrasonic Motion Detectors
12.8 Gas Detectors
12.9 Airborne and Structural Problems
12.10 Audio Detection Systems
13.1 Trade Terms
14.1 Invisible Beam Detectors
14.2 Fence Distrubance Sensors
14.3 Electric - Field Sensors
14.4 Seismic Sensors
14.5 Car Annunicators
15.1 Annunciators
15.2 Fire Extinguishing Systems
15.3 Signal Reporting Systems
16.1 Detection Devices
16.2 Contacts
16.3 Volumetric and Space Devices
16.4 Problems and Applications of Devices
17.1 Key Stations
17.2 Keyless Control Stations
17.3 Types of Annunication
17.4 Shunt Switches

18.1 Red Tape Procedures
19.1 Builder Board Requirements
19.2 Licensing
20.1 Central Stations
20.2 Fire Department Monitoring
20.3 Police Department Monitoring
20.4 Telephone Answering Service Monitoring
21.1 Fire/Police/Emergency Responses
22.1 Card Access Control
22.2 Telephone Access Control
22.3 Computerized Controls and Interfaces
22.4 Key Access Control
22.5 Vehicular Access Control
23.1 Telephone Services
24.1 Basic Sound Systems
25.1 Business Letters
26.1 Video Surveillance Systems
26.2 CCTV Cameras
26.3 CCTV Cables
26.4 CCTV Monitors and Recorders
26.5 Time - Lapse Video Recorders and Videotape
26.6 CCTV Camera Lens
26.7 CCTV Computer Interface Control
26.8 Video Transmission
26.9 CCTV Enclosures
26.10 CCTV Control Equipment

COMPUTER USAGE

27.1 Digital Language
27.2 Digital Logic
27.3 Computer Overview
27.4 Computer Software

HUMAN RELATIONS

28.1 Communication Skills
28.2 Feedback
28.3 Individual Strengths
28.4 Interpersonal Conflicts
28.5 Group Problem Solving, Goal-setting and Decision-making
28.6 Worksite Visits
28.7 Resumes
28.8 Interviews
28.9 Work Habits and Attitudes
28.10 Expectations
28.11 Wider Influences and Responsibilities
28.12 Personal Finance

DRAWING

29.1 Types of Drawings and Views
29.2 Blueprint Reading/Working Drawings
29.3 Scaling and Dimensioning
29.4 Sketching
29.5 Machine and Welding Symbols

LOW VOLTAGE ALARM

SUPPLEMENTARY REFERENCE MATERIAL

Intrusion Detection Systems: Principles of Operation and Application

Author: Robert L. Barnard
Edition: 1981

Understanding and Servicing Alarm Systems

Author: H. William Trimmer
Edition: 1981

In the event additional copies are needed, they may be purchased through:

Butterworth Publishers
10 Tower Office Park
Woburg, Ma. 01801

RECOMMENDATIONS FOR USING TRAINING MODULES

The following pages list modules and their corresponding numbers for this particular apprenticeship trade. As related training classroom hours vary for different reasons throughout the state, we recommend that the individual apprenticeship committees divide the total packets to fit their individual class schedules.

There are over 130 modules available. Apprentices can complete the whole set by the end of their indentured apprenticeships. Some apprentices may already have knowledge and skills that are covered in particular modules. In those cases, perhaps credit could be granted for those subjects, allowing apprentcies to advance to the remaining modules.

We suggest the the apprenticeship instructors assign the modules in numerical order to make this learning tool most effective.

INSTRUCTIONAL LEARNING SYSTEMS

7.1

THEORY OF DIODES

Goal:

The apprentice will be able to describe the theory of diodes and explain their applications.

Performance Indicators:

1. Explain the theory of semi-conductors.
2. Explain materials used in semi-conductors.
3. Explain the process of "doping" and its purpose in the manufacture of diodes.
4. Explain NP junction diodes.
5. Explain the "depletion region" of an NP diode and its effect on current flow.
6. Identify anode and cathode ends of a diode from symbols and determine if it is forward or reversed biased.
7. Explian diode ratings.
8. Identify various types of diodes by symbols.

Study Guide

- Read the performance indicators on the previous page to see what is expected of you to successfully complete this package.
- Study the introduction and information sheets and diagrams.
- Complete the job sheet.
- Complete the self assessment.
- Check self assessment against the answer sheet.
- Complete post assessment.
- Have instructor check completed post tests and score results.

Introduction

Some materials are good conductors of electricity. Other materials serve as insulators. There are also materials in between conductors and insulators that conduct electricity only under certain conditions. Such materials as germanium and silicon have this in-between property and with certain treatments become semi-conductors. Semi-conductor materials are used to manufacture solid state electronic components.

Diodes, transistors and integrated circuits make up the family of electronic components known as solid state devices. With special properties that allow them to be either a conductor or insulator, the semi-conductors function as a type of switch within the circuit.

The semi-conductors have moved us beyond the age of vacuum tubes and have created a technological revolution in the field of electronics.

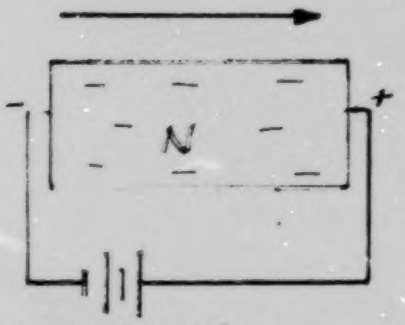
This package explains the theory and applications of one solid state device--the diode.

Information

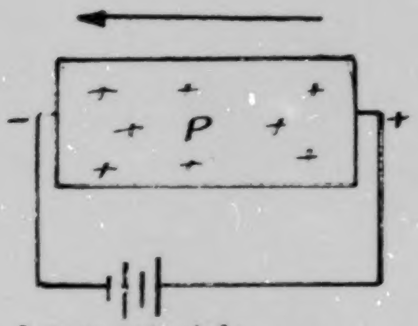
Semi-conductors behave differently than conductors. Unlike conductors, the semi-conductors do not allow current to flow easily. Under the proper conditions, the semi-conductor can become an insulator.

Two materials are used in the manufacture of semi-conductors: silicon and germanium. These materials are used to make diodes, transistors and integrated circuits. The majority of semi-conductors are made with silicon. At room temperature, silicon is an insulator. As temperature is increased, pure silicon becomes a conductor.

Semi-conductors can be made into more efficient conductors of electricity by adding impurities to the silicon material. The process of adding impurities to silicon crystals is referred to as "doping". If materials such as arsenic, phosphorus or antimony are used to "dope" the silicon, a negative type (N-type) materials is formed. N-type semi-conductors have one extra electron. Semi-conductors formed from "doping" with aluminum gallium,boron or indium become positive type (P-type) materials that are shortchanged in the number of electrons. This shortage of one electron makes a weak bond and electrons are taken from nearby bonds. This constant moving of electrons from bond to bond becomes the carrier of electrical current. Diagrams of electron movement through N and P type semi-conductor materials are shown below.



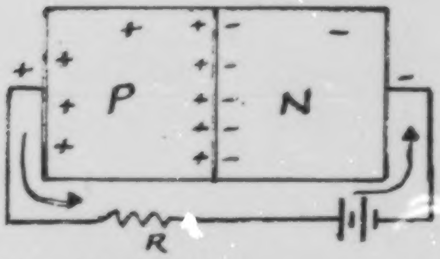
N-type materials:
electrons (-) are attracted
toward positive power
source.



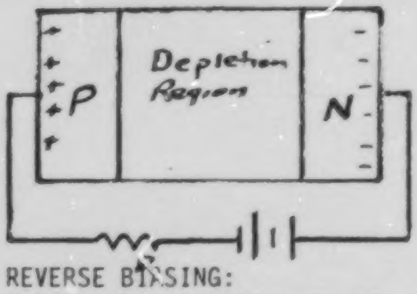
P-type materials:
holes (+) are attracted
toward negative power
source.

Information

A PN junction diode contains both P-type and N-type materials. Where the P and N materials meet is called the "depletion region" of a diode. When voltage is applied to the diode the "depletion region" becomes a semi-conductor. When PN diode is connected to a battery with negative to negative and positive to positive, the depletion region is reduced in size. This reduction in size is due to the electrons and holes rushing into the depletion region because like charge repel each other. As the size of the depletion region is reduced, electrons can flow across the junction. This method is known as "forward bias". If the positive pole of the battery is attached to the N material of the diode and negative is connected to positive, unlike charges will attract and increase the size of the depletion region. This enlarged depletion region serves to block the flow of current. When connected in a positive-negative and negative-positive method, it is termed "reverse bias". In spite of the blocking effect, small amounts of current will flow in a reverse biased junction. This is called "leakage current". The effect of forward and reverse biasing on the depletion region is shown in the following diagrams:

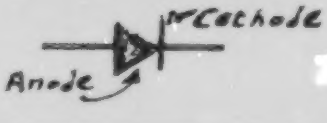


FORWARD BIASING:
Like charges repel and depletion becomes narrow.



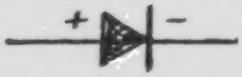
REVERSE BIASING:
Unlike charges attract and depletion region becomes wider.

A diode is divided into two sections. The triangular section is the anode and is made of P-type material. The bar section of the diode is called the cathode and is made of N-type material. See the schematic symbol of a diode:

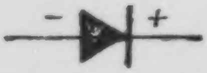


Information

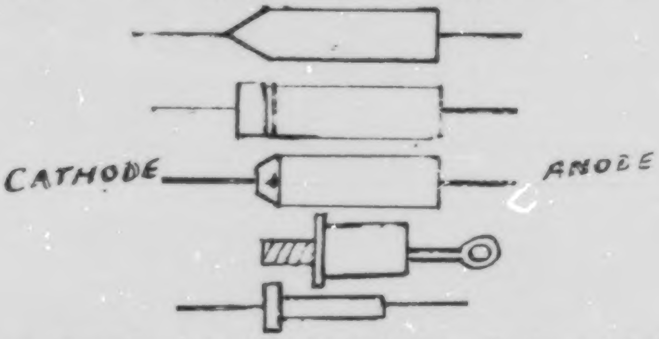
When a diode is shown in a schematic as:



the diode is connected in forward bias. A reverse biased diode will be shown in a schematic as:



Diodes come in many different sizes and shapes. Each diode is marked to show which end is the cathode. A silver band or + sign tells the technician that it is the cathode end of the diode. If the cathode is not well marked, an ohmmeter can be used to identify it. Some typical diode markings are shown below:



Diode ratings are important to the technician. Each manufactured diode has a specific rating such as:

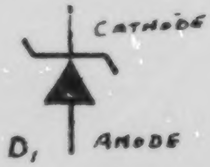
Forward voltage (V_F)
Reverse voltage (V_R)
Forward current (I_F)
Reverse current (I_R)
Reverse breakdown voltage (V_{RB})
Reverse recovery time (t_{RR})
Power dissipation (P)

Information

Each diode rating tells a technician the characteristics of the diode and where it can be used in electronic circuits.

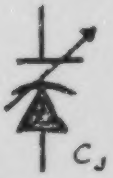
Diodes function as switches as the depletion region is reduced or enlarged. For this reason, diodes are used to convert AC waveform into pulsating DC. Diodes can also be used as a regulator by holding voltage constant in the forward bias. This process is called "clamping". Other uses of diodes are to remove high-frequency modulation from radio transmitters.

Normal rectifying diodes operate in a forward bias. Zener diodes are made to operate in a reverse bias. Zener diodes are made by heavy doping of the silicon materials. The symbol for a Zener diode is:



Zener diodes can be used as voltage regulators. They are numbered so that their ratings can be checked against a semi-conductor manual. Numbers begin with IN, i.e. IN 1725.

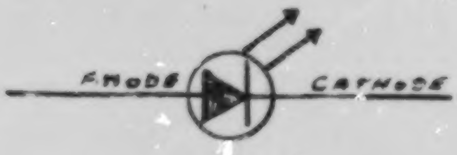
Another special diode is the varicap diode or varactor. These diodes are variable capacitors that are dependent on reverse bias voltage. Varicap diodes are for high frequency applications such as automatic frequency control devices, bandpass filters, FM modulators, RF circuits and tuners. The symbol for the varicap diode is:



Light emitting diodes (LED) give off light when properly biased. These special diodes are used very heavily in the computer industry and in TV channel selectors and sound meters. LED's must be used with current-limiting resistors or else the LED will be destroyed. As resistance is increased, the light or an LED becomes

Information

dimmer. The symbol for an LED is:


ANODE
CATHODE

Assignment

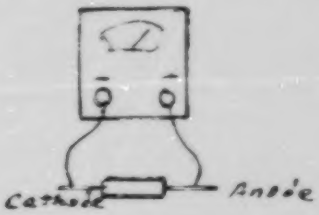
AFTER READING INFORMATION SHEETS:

- Complete self assessment.
- Check self assessment with answer sheet.
- If you fail to give correct answers to less than 8 of the 10 questions on the self assessment, read Chapter 28 of the Introduction to Electronics by Crozier, Breton Publishers.
- Complete the job sheet on identifying diode leads.
- Ask instructor for post assessment.
- Have instructor check post assessment answers.

Job Sheet

IDENTIFY THE CATHODE END OF A DIODE USING A VOM:

1. Place meter on RX100 ohm range.
2. Measure resistance of the diode.



3. Reverse the diode and measure other way.
4. The lower of two resistances indicate that diode is conducting.
5. If electricity is moving from negative terminal of VOM to diode terminal, that end is the cathode.

Self Assessment

1. Define semi-conductor.

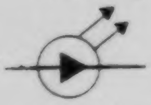
2. Describe the "doping process".

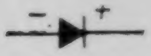
3. Describe the N type and P type sections of a semi-conductor.

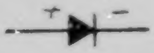
4. Describe how a diode works when forward biased (Use sketch).

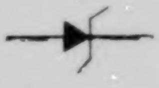
5. Describe how a diode works when reverse biased. (Use sketch).

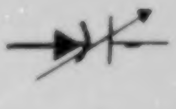
6. Identify the diodes represented by the following symbols:





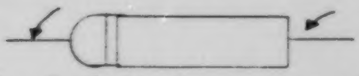


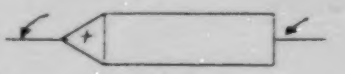




7. Explain the "depletion region" of a diode and how it is affected by forward and reverse biasing.

8. Label the two ends of the following diodes:





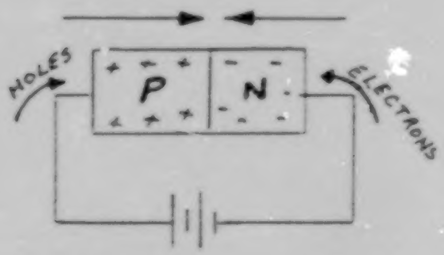
9. Explain the purpose of diode ratings.

10. Where would you most likely find Light Emitting Diodes (LED) being used?

Self Assessment Answers

1. Semi-conductors are materials that conduct under some conditoins and do not conduct under others. They are conductors part of the time.
2. Doping refers to the process of adding impurities to pure germanium or silicon crystals to make them either a positive type or negative type section. One end is treated with a different material and becomes P-type.
3. The N-type section of a diode has an extra electron while the P-section is short on electrons which creates holes that lead to unstable bonding. The N-section of a diode is called a cathode and the P-section is the anode. The diode can be made to behave in different ways through the use of forward and reverse biasing of the current flow.

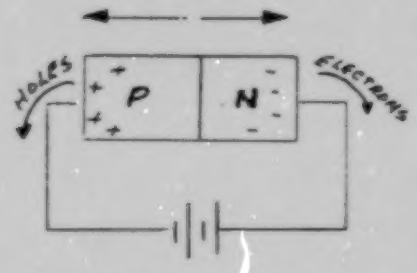
4.



FORWARD BIASED JUNCTION:

Unlike attracts and depletion is reduced in size.

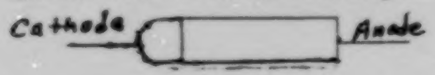
5.

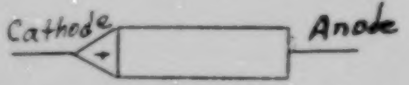


REVERSE BIASED JUNCTION:

Like repels and depletion region becomes wider.

6. a) Light Emitting Diode
   b) Reverse biased diode
   c) Forward biased diode
   d) Zener diode
   e) Varicap diode
7. The "depletion region" is at the junction of the N-type and P-type ends of a diode. The "depletion region" is reduced by forwarding biasing and becomes wider with reverse biasing.
8.





9. Diode ratings are needed for the technician to know the characteristics of various diodes and the conditions under which they will function properly.
10. Computer industry is a heavy user of Light Emitting Diodes.

Post Assessment

1. Draw a schematic of a diode labeling the cathode and anode.

2. Zener diodes are made to operate in :
   a) forward bias or b) reverse bias

3. What type of diodes offer cacacitance to a circuit?

4. Draw a schematic symbol of a varicap diode.

5. Which type of dicde requires a current limiting resistor to prevent it from being destroyed.

6. Draw a schematic symbol for an LED and label each of its terminals.

7. Draw an example of a PN junction in reverse bias.

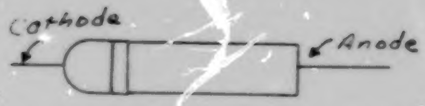
8. Name two materials commonly used in making semi-conductors.

9. The area where the N section and P sections of a diode meet is known as the ______________region.

10. Adding impurities to silicon crystals is known as a ___________ process.

Instructor
Post Assessment Answers

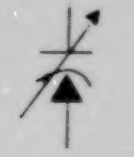
1.


Cathode
Anode

2. Reverse bias

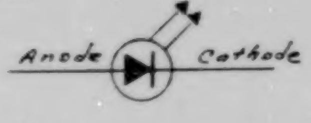
3. Varicap diode

4.

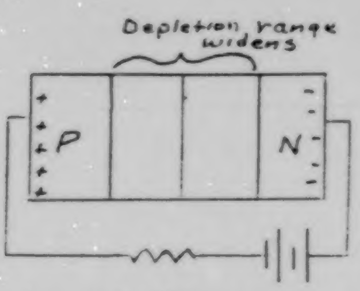


5. LED

6.


Anode
Cathode

7.


Depletion range widens
P
N
+
-

8. Germanium and silicon

9. Depletion

10. Doping

Supplementary References

* Crozier, Patrick. *Introduction to Electronics*. Breton Publishers. North Scituate, Massachusetts. 1983.

* Malcolm, Douglas, R. Jr. *Fundamentals of Electronics*, pages 38-54. Breton Publishers, North Scituate, Massachusetts, 1983.

INSTRUCTIONAL LEARNING SYSTEMS

7.2

THEORY OF BIPOLAR DEVICES

Goal:

The apprentice will be able to explain the theory of bipolar junction transistors.

Performance Indicators:

1. Identify standard terms, symbols and abbreviations for transistors.
2. Identify correct biasing arrangements for NPN and PNP transistors.
3. Identify how electrons flow in NPN and PNP transistor circuits.
4. Label parts of a transistor circuit.
5. Identify basic types of transistors.
6. Test a transistor with ohmmeter to determine if it is good or bad.

Study Guide

- Study the vocabulary for transistors.
- Read the introduction and information sheets.
- Complete job sheet.
- Complete self assessment and check with answer sheet.
- Complete post assessment and have instructor check against answer sheet.
- If you miss three or more of the post test questions, study Chapter 29 in Crozier's Introduction to Electronics. This reference offers more detailed explanations than can be included in a module.

Vocabulary

- Base
- Bias
- Bipolar junction transistor (BJT)
- Collector
- Emitter
- NPN transistor
- PNP transistor
- P
- N
- BJT
- E
- B
- C
- V_{CB}
- V_{BE}
- PNP
- NPN
- I_B
- I_C
- I_E

Introduction

Transistors, like diodes, are made from doped semiconductor crystals. The transistor crystal has three sections instead of the diodes two.

The transistor is often called a bipolar junction transistor (BJT). Bipolar describes the two current carriers in transistors: holes and electrons. Actually the transistor is a junction diode with one additional junction.

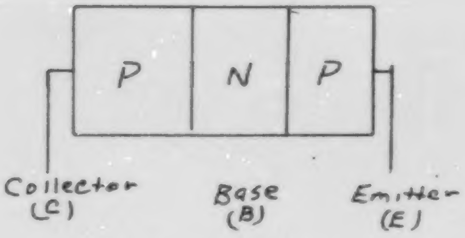
Since Bell Laboratories discovered the amplification power of transistors in 1945, their use in radio, television and other communications devices have led to lightweight and portable equipment.

Information

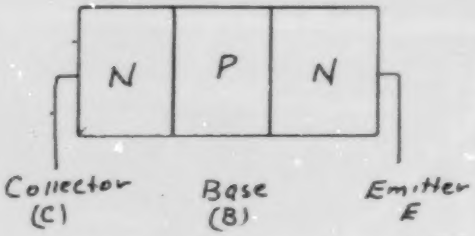
A bipolar junction transistor (BJT) is a three terminal semiconductor current controlled device. Bipolar refers to the two types of current carriers--electrons and holes. It is normally used as a control switch or as a signal or power amplifier. Transistors are made of semiconductor materials--silicon and germamium. They are very much like diodes in that the crystals are "doped" to develop N and P regions. In diodes, the region "depletion region" was found where the N and P regions met. Transistors have three regions and two junctions of N and P materials.

The transistor has three parts of doped semiconductor materials. This may be two N parts and one P parts which gives a NPN transistor. If it has two P parts and one N part, it is called a PNP transistor.

Each layer or section of a transistor has a specific function. The layers are called the Base (B), Emitter (E) and Collector (C). Each section has a connecting lead. The sections of PNP and NPN transistors are shown below:



PNP TRANSISTOR



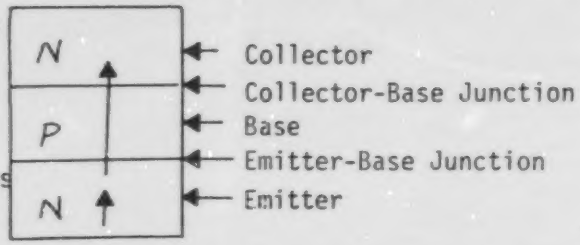
NPN TRANSISTOR

The current path is developed through a transistor by two current carriers--holes and electrons. The "doping" pattern of the silicon crystals determine how the current moves through the transistors.

Lightly doped material allows current carriers to be collected.

Material lightly doped to control current.

Heavily doped material enables current carrier to be ejected.

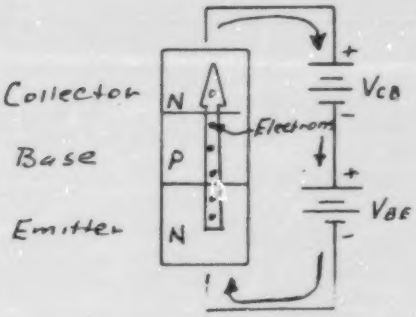


Information

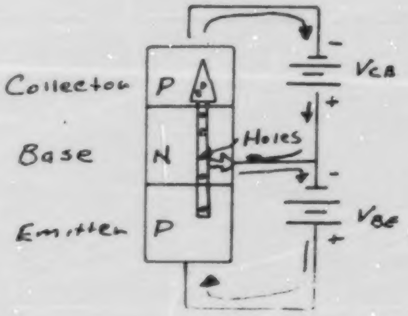
Electrons are the major current carrier in NPN transistors. As electrons are injected into the emitter, they are attracted to the base region and pass across it. Once across the base, the electrons come under the force of a positive collector. The electrons are pulled through the collector to the power supply for the collector base (V_{CB}). The electrons are supplied by negative voltage power supply for the emitter (V_{BE}). The two power supplies are important features of transistors.

Holes are the current carriers for PNP transistors. The emitter must have the positive part of V_{BE} attached to its terminal in a forward bias while the collector base junction must be reversed biased. The V_{CB} must have its negative terminal connected to the collector lead and the base region must have a positive voltage in order to reverse bias the collector base junction. Biasing methods differ between NPN and PNP transistors.

Diagrams of biasing NPN and PNP transistors are shown below:



NPN BIASING

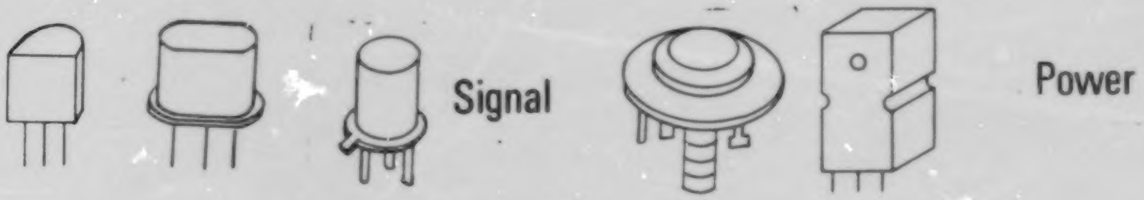


PNP BIASING

Biasing methods for NPN and PNP transistors are completely different. Because of this, the two transistors cannot be interchanged in a circuit. Both types perform as amplifiers, oscillators and regulators but cannot replace one another without changing the biasing of the circuit.

Information

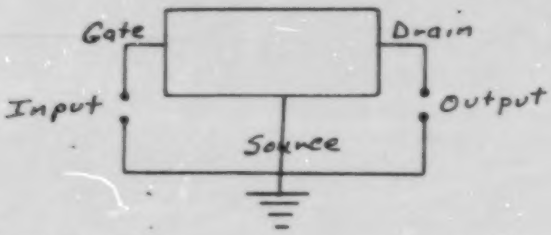
Transistors are of two basic types--power and signal. The power transistor is rather large and handles large currents. The signal transistor is small and handles small currents. Some typical transistor types are shown below:



Other types of specialized transistors include field effect transistors (FET) and metal-oxide semiconductor field effect transistor (MOSFET).

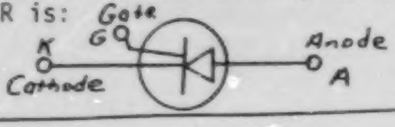
FIELD EFFECT TRANSISTOR (FET)

The FET is called unipolar because it only requires one type of current carrier. Holes carry P-type material and electrons carry N-type material. It operates on low DC voltage and is very much like the bipolar transistor. FETS have three terminals--gate, source and drain which correspond to the base, emitter and collector of a bipolar transistor.



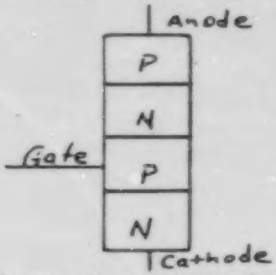
SILICON CONTROLLED RECTIFIERS

The silicon controlled rectifier (SCR) is a special semiconductor device. An SCR has three junctions and functions as a switch. It has the ability to switch between on and off quickly. The symbol of an SCR is:

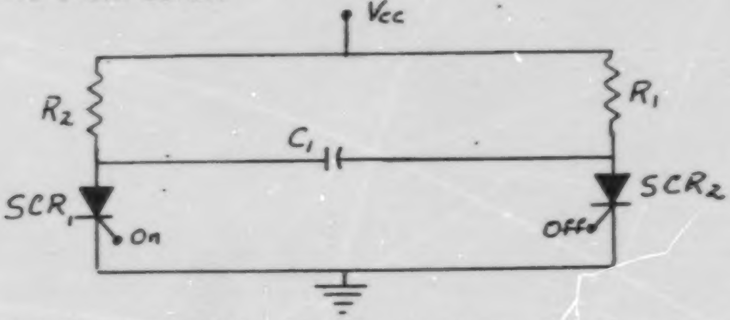


Information

The SCR is made by four layers of P and N material. Remember that diodes used two layers and the transistor used three layers of P and N materials.



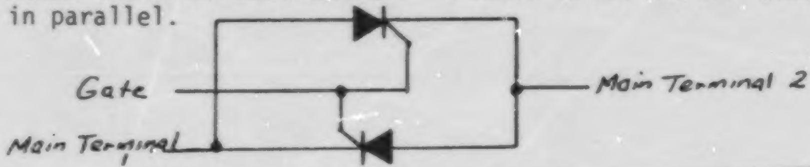
The SCR turns on when the anode-cathode junction is forward biased and a positive voltage is applied at the gate. It can be used to control the power delivered to the load or to switch power on and off. Since the SCR can only control power in one direction, two are needed to make an on-off switch. This on-off switching arrangement is shown below:



An electrical pulse is applied to SCR, to start the cirucit and to SCR_2 to turn it off.

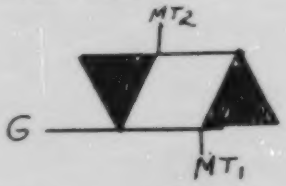
TRIACS

The triac is very much like the SCR except that it can conduct electricity in both directions. This makes the triac more useful. A basic triac can be formed by placing two SCR's in parallel.

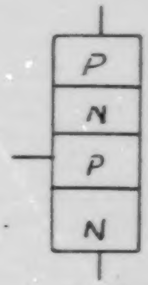


Information

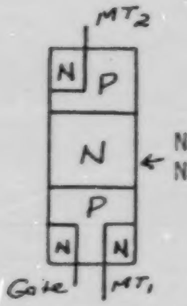
The schematic symbol of the triac is:



The structure of the NP layers show that the triac can function as two SCR's in parallel.



SCR



Notice that current can pass through NPNP or PNPN

TRIAC

Triacs have some disadvantages when compared to SCR's. SCR's can operate at much higher levels of current. Triacs are slow under inductive loads. They operate in a low frequency range.

Assignment

- Study the information sheets of the module.
- Take self assessment and check answers.
- Complete job sheet on testing transistors.
- Ask instructor for post assessment.
- Complete post assessment and have instructor check results with post assessment answer sheet.

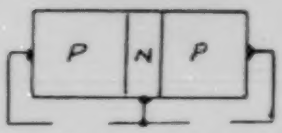
Job Sheet

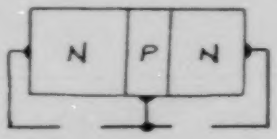
TEST TRANSISTORS

- Obtain tools and equipment
  - Transistors (Signal and power types)
  - Ohmmeter
- Identify positive and negative leads on ohmmeter.
- Identify emitter, base and collector leads on transistor.
- Turn ohmmeter on R X 100 range.
- Determine forward-biased emitter base junction
  - Positive lead on ohmmeter to emitter lead. Negative lead on ohmmeter to base lead.
  - Read resistance.
  - Negative ohmmeter lead on emitter and positive lead on base.
  - Read resistance.
  - Compare two resistance readings
  - Repeat five steps above with collector base junction.
- Identify from readings whether the transistor is good or bad. If both readings are low, the junction is shorted and the transistor is not good.
- Identify from readings whether the transistor is NPN or PNP.

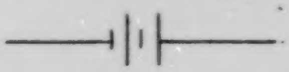
Self Assessment

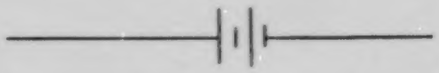
1. Draw a block diagram of a PNP transistor and label its parts. Show leads.
2. Draw a block diagram of a NPN transistor and label its parts. Show leads.
3. Draw symbol (schematic) for PNP transistor.
4. Draw symbol for NPN transistor.
5. Complete the following biasing drawings..





6. Show how electrons flow through a NPN circuit. Use arrows.
7. List two major types of transistors.
8. Show (+) and (-) values of the following battery leads.

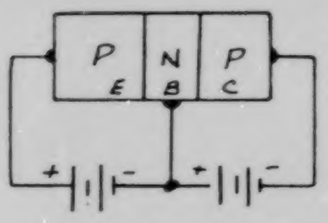




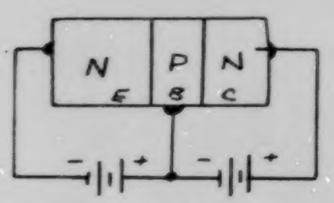
9. What is doping?
10. What must be done in order to replace a PNP transistor with a NPN transistor?

Self Assessment Answers

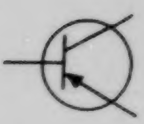
1.



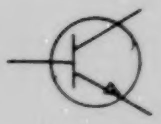
2.



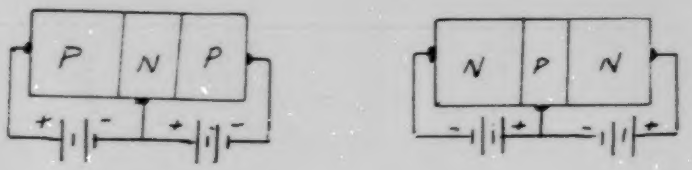
3.



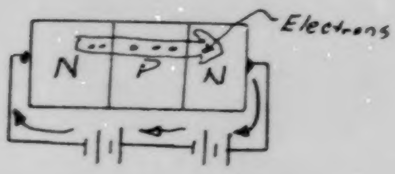
4.



5.

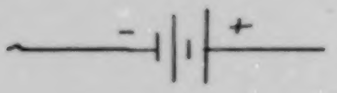


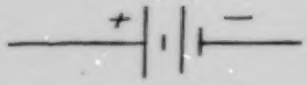
6.


Electrons
N
P
N

Self Assessment Answers

7. Signal and power

8. 

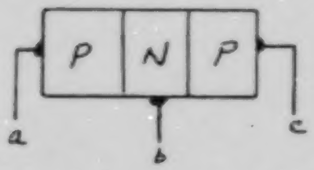


9. Impurities are added to silicon crystals to create semiconductor characteristics.

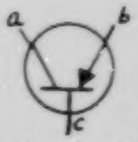
10. Cannot be interchanged because of biasing methods.

Post Assessment

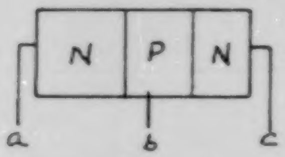
1. Identify basic elements in this block diagram of a PNP transistor.



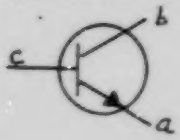
2. Identify basic elements in this schematic of a PNP transistor.



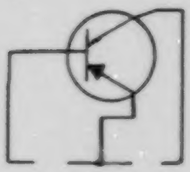
3. Identify basic elements in this block diagram of a NPN transistor.

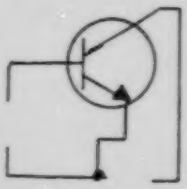


4. Identify basic elements in this schematic of an NPN transistor.



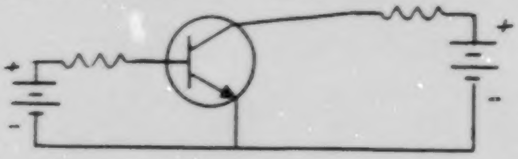
5. Show correct biasing arrangements for NPN and PNP transistors by drawing battery connections into the circuit schematics below.



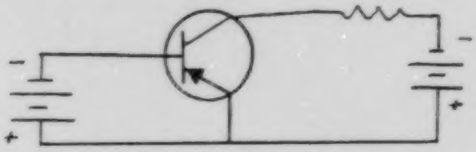


Post Assessment

6. Draw electron flow in this NPN circuit.

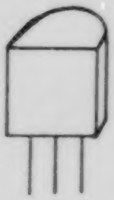


7. Draw electron flow in the PNP circuit below.

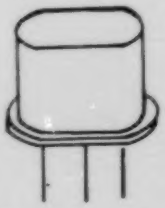


3. Identify the signal and power transistors below by placing (P) by power and (S) by signal transistors.

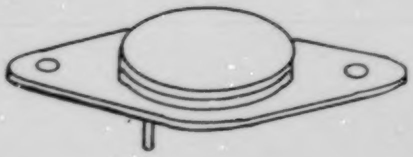
a



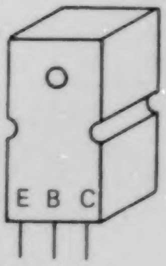
b.



c.



d.



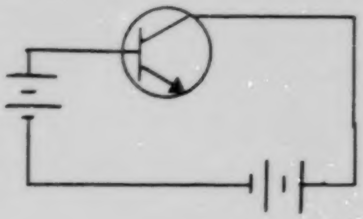
9. Match the following transistor terms with their standard abbreviations.

______ a. I_B	1. Transistor base lead.
______ b. C	2. Transistor--emitter lead
______ c. E	3. Transistor collector lead
______ d. I_E	4. Base current
______ e. B	5. Emitter current
______ f. I_C	6. Collector current

10. Label the transistor circuit shown below. Show category of transistor (NPN or PNP). Leads (emitter, base, collector), battery bias, and electron circuit flow.

Post Assessment

10. (continued)



Instructor Post Assessment Answers

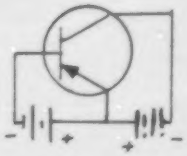
1. a. Emitter
   b. Base
   c. Collector

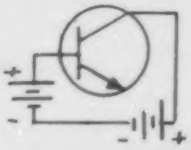
2. a. Emitter
   b. Collector
   c. Base

3. a. Emitter
   b. Base
   c. Collector

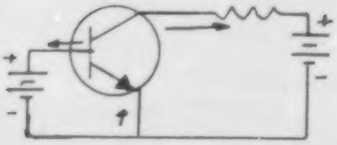
4. Emitter
   Collector
   Base

5.

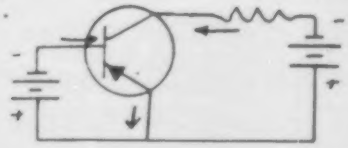




6.



7.

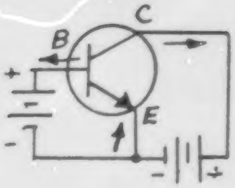


Instructor Post Assessment Answers

8. a. signal c. power
   b. signal d. power

9. a. 4
   b. 3
   c. 2
   d. 5
   e. 1
   f. 6

10.



NPN

Supplementary References

- Malcolm, Douglas R. Jr. Fundamentals of Electronics. Breton Publishers. North Scituate, Massachusetts. 1983. Pages 89-106.

INSTRUCTIONAL LEARNING SYSTEMS

7.3

THEORY OF INTEGRATED CIRCUITS

Goal:

The apprentice will be able to describe integrated circuits and their logic families.

Performance Indicators:

1. Describe integrated circuits.
2. Describe the logic family groups and their basic logic gates.
3. Describe how IC's are numbered for identification.

Study Guide

- Read the goal and performance indicators to find what is to be learned from package.
- Read the vocabulary list to find the new terms to be learned.
- Read the introduction and information sheets.
- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Vocabulary

- AND gate
- Black boxing
- Complimentary metal oxide semi-conductor (CMOS)
- Digital logic
- Diode -- transistor logic (DTL)
- Field effect transistor (FET)
- Flip-flops
- Integrated circuit (IC)
- Logic gate
- MOS
- NAND gate
- NOR gate
- P-Channel metal oxide semi-conductors (PMOS)
- Pins
- Resistor -- transistor logic (RTL)
- Transistor-transistor logic (TTL)

Introduction

The integrated circuit (IC) is an advanced application of semi-conductors. Complete circuits are built on tiny silicon chips. These tiny chips have resulted in a technical revolution called digital electronics.

Digital circuits are associated with logic families. The logic family is determined by the electronic components used in making the IC chip. An IC that is built on transistor to transistor logic is called a TTL IC. The TTL uses the NAND logic gate.

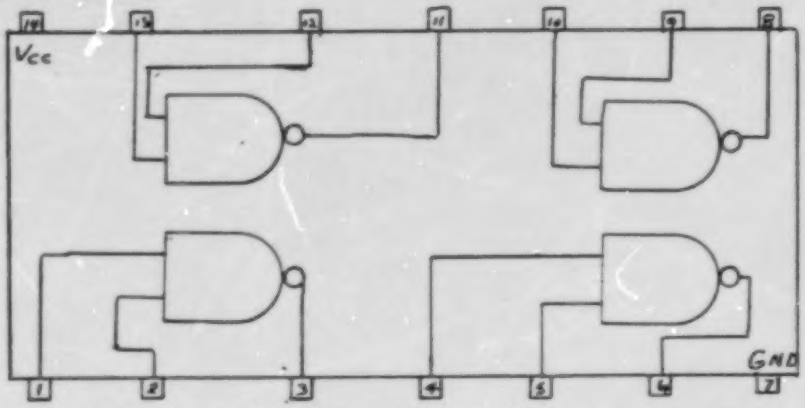
The technician that understands logic families and basic logic gates will find it easy to work on digital equipment.

Information

Integrated circuits are thin wafers of semi-conductor material with electronic circuits. Within this IC "chip", we find diodes, transistors, resistors, capacitors and internal wiring. It is impossible to replace any of the electronic components within an integrated circuit. If one of the internal components is faulty, the entire "chip" must be replaced. We refer to this practice as "black boxing" or replacement of several components at one time.

Digital circuits require that data be entered in a numerical form and that it be in a logical order. The order in which a digital circuit receives and processes data depends on how the system is constructed and what we want it to do. The way in which the circuits process data is called digital logic.

A logic gate is a circuit that has two or more inputs and one output. Output depends on the logic signals that you can inject into the inputs. Sometimes a manufacturer will combine several gates in one IC. In that case, a drawing with logic symbols and pin numbers will provide the needed information. A quadruple 2 input NAND gate is shown below.

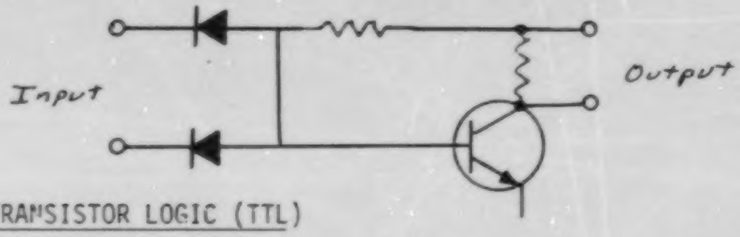


This drawing shows four logic gates (circuits) with inputs on pins 1, 2, 4, 5, 9, 10, 12, 13 and outputs on pins 3, 6, 8, 11. A troubleshooter must understand the characteristics of the input and output for each of the logic family groups.

Information

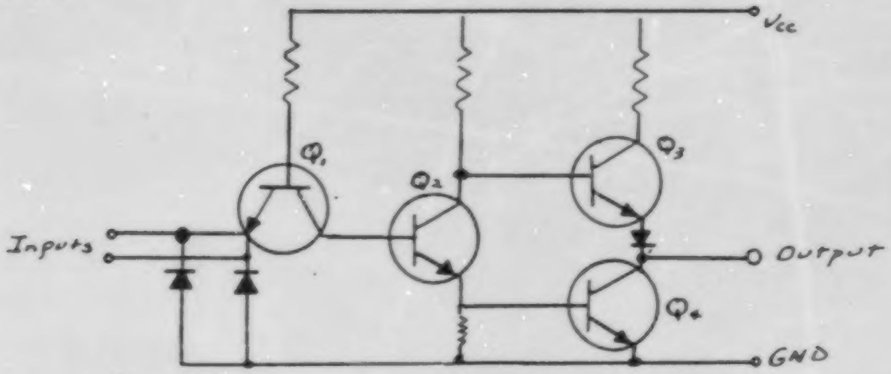
DIODE-TRANSISTOR LOGIC (DTL)

The basic logic gate for DTL is the NAND gate. The diode produces an AND function and the transister serves as an inverter to produce the NAND gate. A DTL NAND gate is shown below.



TRANSISTOR-TRANSISTOR LOGIC (TTL)

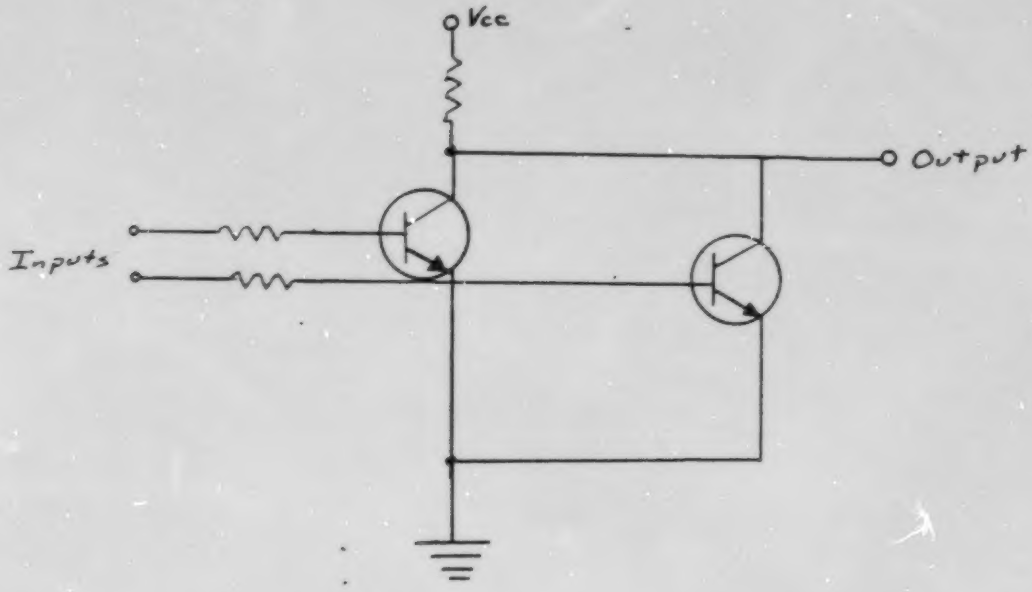
In TTL logic, one transistor performs an AND function and the other serves as an inverter to produce a NAND function. A schematic diagram of a TTL NAND gate is shown below.



Information

RESISTOR-TRANSISTOR LOGIC (RTL)

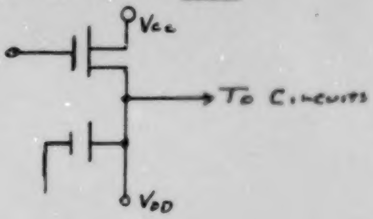
The basic RTL gate is very simple. It contains two transistors and three resistors. RTL logic has many applications. It is used in flip-flops, encoders, decoders and counters. This logic is composed of simple resistance coupled transistor circuits. The basic RTL NOR gate is shown below.



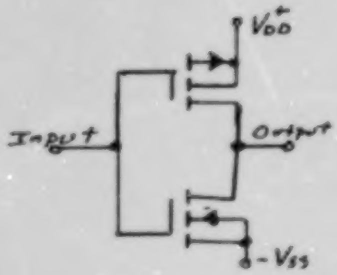
Information

METAL OXIDE SEMI-CONDUCTOR (MOS)

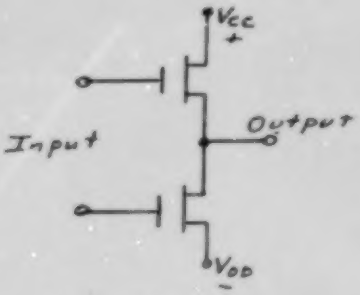
The MOS and its related families of PMOS and CMOS all use a metal oxide semi-conductor field effect transistor as a switching device. The PMOS uses P-channel enhancement mode FET's. A circuit that uses both N and P channel FET devices is a complimentary circuit known as CMOS.



PMOS



CMOS
INVERTER



MOS
PUSH-PULL

IDENTIFICATION OF LOGIC GATES

Integrated circuits are numbered so that they can be identified according to their characteristics. For example, the number N7400 means:

N - industrial type
74 - operates safely between 0° and +70° centegrade
00 - standard IC

A letter between 74 and 00 would designate switching characteristics. Since the example did not include a letter, it is a standard IC.

Assignment

- Read pages 11-19 in Digital Electronics. Genn, Robert L. Prentice-Hall, Inc. Englewood Cliffs, N.J.. 1982.
- Complete job sheet.
- Complete self assessment.
- Complete post assessment.

Job Sheet

EXAMINE INTEGRATED CIRCUITS

- Obtain one or more integrated circuits. Ask your instructor for precautions to be taken in handling the IC chip.
- Examine integrated circuit under a magnifying glass.
- Find the input pins.
- Find the output pins.
- Find IC indentification numbers.
- Determine which logic family is represented by the IC.

Self Assessment

1. What does the term MOS mean?

2. A logic gate has ______________________ inputs.

3. A logic gate has _________________outputs.

4. The DTL logic family uses the _______________ logic gate.

5. The TTL logic family uses the ___________ logic gate.

6. The RTL logic family uses the ____________ logic gate.

7. Most IC chips are made from thin wafers of _______________.

8. The replacement of entire chips is known as ____________________.

9. The inputs and outputs of logic gates are designated on drawings by ______________________________ numbers.

10. The way in which circuits process data is called digital ___________________.

Self Assessment Answers

1. Metal-oxide semi-conductors
2. Two or more
3. one
4. NAND
5. NAND
6. NOR
7. Silicon
8. Black boxing
9. Pin numbers
10. Logic

Post Assessment

1. Which electronic components are used in making a TTL integrated circuit?

2. Which ones are used in a DTL circuit?

3. Which logic family uses field effect transistors (FET)?

4. What does the number N 7400 tell us about an IC chip?

5. Does an IC have only one logic gate?

6. Which logic gate is used by the DTL logic family?

7. Which logic gate is used by the TTL logic family?

8. Which logic gate is used by the RTL logic family?

9. Which logic family is found in such devices as encoders, decoders, flip-flop and counters?

10. How many outputs is found on a logic gate?

Instructor Post Assessment Answers

1. Transistor to transistor

2. Diodes to transistor

3. MOS, PMOS, CMOS family

4. N - industrial type IC
   74 - operational temperature range
   00 - standard IC

5. May have more than one.

6. NAND

7. NAND

8. NOR

9. RTL

10. One

Supplementary References

- Genn, Robert C. Jr. Digital Electronics: A Workbench Guide to Circuits, Experiments and Applications. Prentice-Hall, Inc. Englewood Cliffs, N.J. 1982.

INSTRUCTIONAL LEARNING SYSTEMS

8.1

BINARY NUMBERING SYSTEMS

Goal:

The apprentice will be able to describe binary numbering systems.

Performance Indicators:

1. Identify numbers in decimal, binary, octal and hexadecimal forms.
2. Convert binary numbers to decimal form.
3. Convert decimal numbers to binary form.

Study Guide

- Read goals and performance indicators to determine what you are supposed to learn from package.
- Study vocabulary words.
- Read the introduction page.
- Study the information sheets.
- Complete the self assessment sheets and check answers with answer sheet.
- Read reference if self assessment shows that you need more information for an understanding of the numbering systems.
- Complete post assessment and have instructor score answer.

Vocabulary

- Binary Number System
- Decimal Number System
- Octal Number System
- Hexadecimal Number System
- Bit
- Binary point

Introduction

Digital systems use the binary numbering system as their language. A computer processes information by a series of 1's and 0's. Information is fed into a digital system in decimal form and the output is shown in decimal numbers. This means that the input must be converted to binary numbers by an encoder. After the numerical functions are completed, the output is converted back to decimal numbers by a decoder device.

Octal and hexadecimal numbers are variations of the binary system that help people communicate with computers.

Information

DECIMAL SYSTEM

The decimal system has ten numbers -- 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. As we move left from a decimal point, the value of the number is increased ten times. For example, 100. is ten times ten and 1,000 is ten times 100. The position in relation to the decimal point tells us the value of decimal numbers. This may be expressed in powers of ten as shown below:

DECIMAL SYSTEM

10^3	10^2	10^1	1's
			0
			1
			2
			3
			4
			5
			6
			7
			8
			9
		1	0
		1	1
		1	2
		1	3
		1	4
		1	5

After 9 in a decimal system, the numbers spill over into another column to give tens, hundreds, thousands.

Information

BINARY SYSTEM

In the binary system, we only have two numbers — 0 and 1. The decimal point is called a binary point. As we move left from the binary point, the value of numbers in each column is increased by a power of 2. For example, the binary numbers 101 would represent a decimal 5:

Columns	Fours		Twos		Ones		
101. Binary Point	1		0		1		
	1 X 4		0 X 2		1 X 1		
	4	+	0	+	1	=	5

An example of decimal numbers 0 - 15 expressed in binary:

DECIMAL	Binary Numbers			
	2^3	2^2	2^1	1s
0				0
1				1
2			1	0
3			1	1
4		1	0	0
5		1	0	1
6		1	1	0
7		1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

Information

CONVERTING DECIMAL TO BINARY

The decimal system starts with a 0 which is the starting point of binary numbering. The 1 is the same in decimal and binary. But since binary has only 0's and 1's, numbers larger than 1's require additional columns. The columns increase in weight by a power of 2 as we move left of the binary point.

Let us try counting to ten in binary. The highest number that we can have in binary is 1. After that it must spill over into another column. When it spills over, you must return the first column to zero and use a 1 in the second column. Study this example:

Decimal				Binary	
0				0	
1				1	This is highest we can go in one column.
2			1	0	This column return to 0 and column to left becomes 1
3			1	1	
4		1	0	0	Note 3rd column to the left becomes 1
5		1	0	1	
6		1	1	0	Note 1st column becomes zero and 2nd column becomes 1
7		1	1	1	
8	1	0	0	0	Note 4th column becomes 1
9	1	0	0	1	
10	1	0	1	0	

CONVERTING BINARY TO DECIMAL

Let us convert the binary number 1100 into decimal numbers.

Information

	2^3	2^2	2^1	2^0
BINARY	1	1	1	0

DECIMAL 8 + 4 + 1 + 1 = 14

RULES:

- Any number to zero power equals 1
- Any number to first power is equal to itself
- Each position to left is worth twice as much as column to its right

Please note the rule that any number to zero power is equal to one and that any number to first power is equal to its own value. Each column to the left then becomes worth twice as much as the preceding column.

Let us try another example such as 1111, using the rules given above.

	2^3	2^2	2^1	2^0
BINARY	1	1	1	1

DECIMAL 8 + 4 + 2 + 1 = 15

* $2^0 = 1$

$2^1 = 2$ because it is worth twice as column to its right

$2^2 = 4$

$2^3 = 8$

OCTAL NUMBERING SYSTEM

Computer programmers find it difficult to memorize binary sequences and there is a high degree of error when they try to program in straight binary. The octal (base 8) and hexadecimal (base 16) numbers are used to simplify the process. To convert binary to octal numbers, you start at the ones column and count off by threes to the left. For example, the binary 1101011111 would be grouped as:

001	101	011	111	BINARY
1	5	3	7	OCTAL

Information

Each three binary columns would be converted to an octal digit. Any octal digit (0-7) is represented by three digits of binary. The octal, binary and decimal numbers 1-10 are shown below.

OCTAL	BINARY	DECIMAL
0	000	0
1	001	1
2	010	2
3	011	3
4	100	4
5	101	5
6	110	6
7	111	7
10	1000	8
11	1001	9

To convert octal to binary, just fill in three binary digits for each octal digit. Add zeros to left if the binary has less than three digits.

HEXADECIMAL NUMBERING SYSTEM

Hexadecimal (Base 16) numbers represent four binary digits. The hexadecimal system runs numbers 0 through 9 and then use letters (A-F) to represent numbers up through fifteen. The hexadecimal numbers and corresponding binary and decimal numbers are listed below:

HEXADECIMAL	BINARY	DECIMAL
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7

(continued on next page)

Information

HEXADECIMAL	BINARY	DECIMAL
8	1000	8
9	1001	9
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

After this chart is memorized, it is easy to convert between hexadecimal and binary numbers. In fact, conversion between octal, hexadecimal, binary and decimal systems is easy once the two charts have been memorized. An example is shown below:

Octal numbers	4	0	2	1
Binary (groups of three)	100	000	010	001
Binary (groups of four)	1000	0001	0001	
Hexadecimal numbers	8	1	1	

or in reverse, starting with hexadecimal numbers, we can convert them to binary and then to octal numbers.

Hexadecimal	8	1	1	
Binary (groups of four)	1000	0001	0001	
Binary (groups of three)	100	000	010	001
Octal	4	0	2	1
Decimal equivalents of octal	4	0	2	1
Decimal equivalents of hexadecimal	8	1	1	

The octal and hexadecimal systems allow us to convert data into machine language and back into decimal numbers with great ease.

Assignment

- Read information
- Complete self assessment
- Complete post assessment with satisfactory score.

•Self Assessment

1. Count to ten in digital numbers.

    1. ______________
    2. ______________
    3. ______________
    4. ______________
    5. ______________
    6. ______________
    7. ______________
    8. ______________
    9. ______________
    10. ______________

2. Convert the following binary numbers to octal numbers:

    010111011000101 BINARY

    ______________ OCTAL

3. Convert 011001111101 to hexadecimal numbers. ______________

4. Convert hexadecimal number 5B8E to binary numbers. ______________

5. Convert hexadecimal number 7C to octal. ______________

6. Convert octal number 723 to hexadecimal number. ______________

7. What is the base power of hexadecimal numbers?

8. What is the base power of octal numbers?

9. What is the base power of decimal system numbers?

10. What is the base power of binary numbers?

Self Assessment Answers

1. 0) 000
   1) 001
   2) 010
   3) 011
   4) 100
   5) 101
   6) 110
   7) 111
   8) 111
   9) 1000
   10) 1001

2. 2 7 3 0 5

3. 6 7 D

4. 0101 1011 1000 1110

5. 174

6. 1 D 3

7. Sixteen

8. Eight

9. Ten

10. Two

Post Assessment

Convert the following. Remember the systems to be converted are shown by their base powers of 2, 8 and 16.

1. $1\ 0\ 1\ 0\ 1\ 1\ 0_2$ to ____________________8.
2. $A\ 5\ 3\ 9_{16}$ to ____________________8.
3. $4\ 6\ 6\ 3_8$ to ____________________16.
4. $59\ D_{16}$ to ____________________8.
5. 11011011101101_2 to ____________16.
6. 43_8 to ____________________2.
7. 43_{16} to ____________________2.
8. 101_{16} to ____________________8.
9. 101_8 to __________________16.
10. 101_2 to __________________16.

Instructor Post Assessment Answers

1. 126
2. 122471
3. 9 B 3
4. 2635
5. 36 ED
6. 100011
7. 1000011
8. 401
9. 41
10. 5

INSTRUCTIONAL LEARNING SYSTEMS

8.2

LOGIC GATES

Goal:

The apprentice will be able to describe the basic types of logic gates used in digital electronic systems.

Performance Indicators:

1. Recognize logic symbols for basic logic gates.
2. Interpret truth tables for basic gates.
3. Reconize Boolean expressions for basic logic gates.
4. Describe function of logic 1 and logic 0 in operation of digital switches.
5. Describe translation of decimal numbers to binary numbers and binary numbers to decimal numbers.

Study Guide

- Read goal and performance indicators to determine what is to be learned from package.
- Read the vocabulary page, assignment sheet and introduction sheet.
- Study the information sheet until you understand the symbols, truth tables and Boolean expressions for basic logic gates. Make sure you understand the meaning of words listed on vocabulary sheet.
- Complete the job sheet
- Complete self assessment and check answers with self assessment answer sheet.
- If self assessment results are unsatisfactory, study chapter in reference listed on reference sheet.
- Complete post assessment.
- Have instructor check answers with post assessment answer sheet.

Vocabulary

- Analog circuit
- AND gate
- Astable multivibrator
- Binary numbers
- Boolean expressions
- CMOS
- Decoder
- Digital circuits
- Digital clocks
- DTL
- Encoder
- JK flip-flop
- NAND gate
- NMOS
- NOR gate
- PMOS
- RTL
- Schmitt trigger
- Square waves
- Truth table
- TTL
- Wave shaping current

Introduction

Digital logic refers to the way a digital circuit processes numbers. Digital circuits differ from analog circuits. The hands of an analog clock move continuously. A digital watch does not move continuously but rather by a number of fixed steps. In the case of the digital watch, the time is advanced each minute. This is the major difference between analog and digital devices.

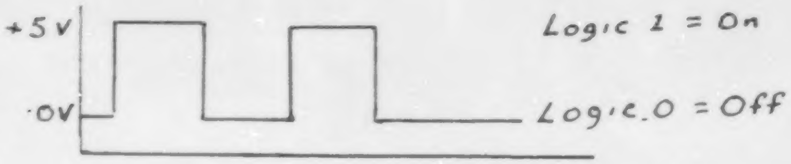
Digital circuits perform basically the same functions as a series of mechanical switches. When a switch is closed, the binary value is 1. When the switch is open, the binary value is 0.

Digital circuits are classified according to logic familes or logic gates. The technician must understand the basic logic gates in order to work with digital devices.

Information

BINARY NUMBERING SYSTEM

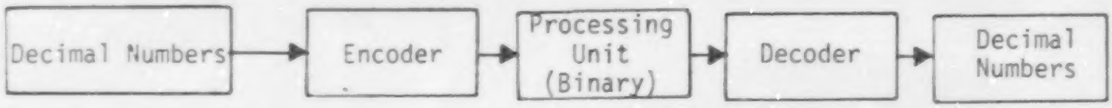
Digital systems operate with binary numbers instead of the decimal system that is used in everyday life. Digital signals are known as "square waves" becuase of its on-off nature. The wave rises from 0 level to its peak and drops back to 0 in a vertical manner. At its peak, the wave is logic 1 and at its lowest level it is logic 0.



So digital systems operate on a series of 1's and 0's that can only be expressed as Base 2 (binary) numbers. A separate learning package has been developed to explain the binary numbering system.

TRANSLATION OF DECIMAL TO BINARY NUMBERS

When commands are given in decimal numbers, a digital system must convert them into binary numbers. An encoder device translates decimal numbers into binary numbers so that the information can be processed. After processing, a decoder will translate the binary information back into decimal numbers. The following flow chart shows how information is translated from decimal to binary and back to decimal.



LOGIC FAMILIES

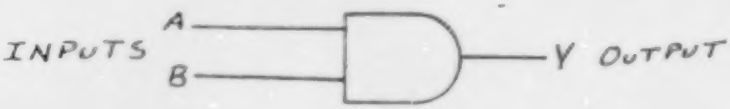
The process described above is possible by using logic gates or logic families. Binary logic gates are the building blocks of a digital system. There are some basic logic families with two inputs:

Information

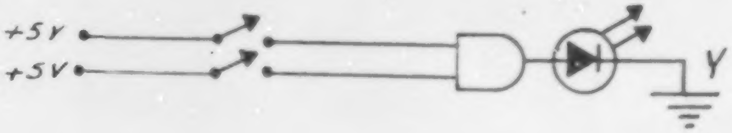
AND gate (all-or-nothing gate)
OR gate (any-or-all gate)
Inverter gate (NOT circuit)
NAND gate (inverted AND gate)
NOR gate (combined OR and inverter gate)
Flip-Flops

AND GATE

A typical AND gate is represented by the following diagram:



Each type of logic gates are identified by a logic symbol such as the following AND gate:



Truth tables are made to show all of the possible combinations of input and output. If A and B represent input and Y represents output, the truth table for an AND gate would be:

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

Information

This truth table shows that the output of an AND gate can only be 1 when both inputs are also 1. Those people that work with digital systems must know how to read truth tables.

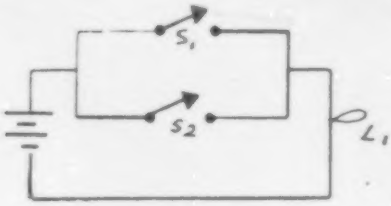
Logic gates are also defined by a form of algebra called Boolean. The Boolean expression for the AND gate is:

$$A \cdot B = Y$$

This equation reads A and B (inputs) = Y (outputs)

OR GATE

A basic circuit diagram for an OR gate is shown below:



The OR gate must have only one logic 2 input to give a logic 1 output. This differs from the AND gate which required that both switches be closed to give a logic 1 output. In the diagram above, the closing of either S_1 or S_2 switches will result in logic 1 output.

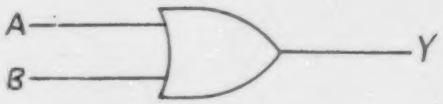
The truth table for an OR gate would read as follows:

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

Information

The only way to get a logic 0 output in an OR gate is to have both switches open or stated in digital terms -- two logic 0 inputs. That is why the OR gate is called the "any-or-all" gate.

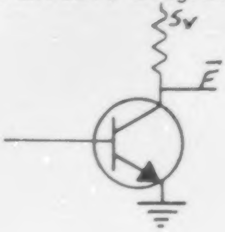
The logic symbol of an OR gate is:



The Boolean expression for the OR gate is $A + B = Y$ which means that A or B equals Y.

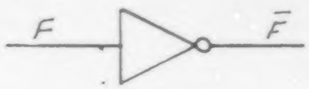
INVERTER GATE

The inverter gate or NOT gate changes the input to its opposite state. If we input logic 2, the output will be logic 0. Sometimes the output is listed as $\bar{F}$ which means "not F" or 0. A circuit diagram and truth table for an inverter gate might look as follows:



F	$\bar{F}$
0	1
1	0

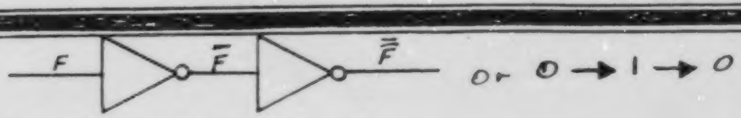
The logic symbol for an inverter gate is:



The Boolean expression would be $F = \bar{F}$ and is read as F equals NOT F.

In some digital applications, a double inversion is utilized to make the output equal to the input:

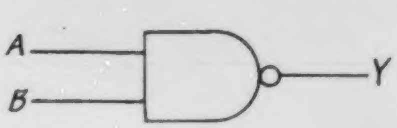
Information



The Boolean expression would be F = NOT F = F.

NAND GATE

An inverted AND gate is called a NAND gate. The logic symbol for a NAND gate is:



The NAND Truth Table would be:

A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

The Boolean expression for a NAND gate is:

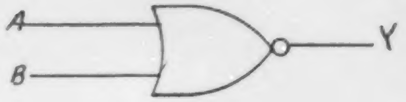
$$\overline{A \cdot B}$$

which means that the output is inverted and is read as A and B equals NOT A and B.

NAND gates can be wired to serve as AND gates, OR gates and NOR gates. For this reason it is widely used in industry. The NAND gate is referred to as the universal gate.

NOR GATE

The NOR gate is a combination of the OR gate and the inverter. The logic symbol for the NOR gate is :



Information

The NOR gate is represented in the following Truth Table:

A	B	Y
0	0	1
1	0	0
0	1	0
1	1	0

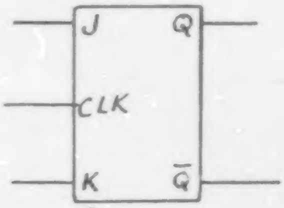
The Boolean expression for this gate is:

$$\overline{A + B} = Y$$

and reads NOT A or B equals Y.

FLIP-FLOPS

Sometimes it is necessary to change logic states between the input and output of a circuit. A flip-flop current is used to change the logic state. The basic types of flip-flops are RS, D and JK. The most widely used flip-flop is the JK which is represented by the following logic symbol.



A clock pulse (CLK) is required to operate the flip-flop. J and K are input terminals while Q and $\overline{Q}$ represent output terminals. When the clock pulse is high and J's and K's are 0's, the flip-flop is disabled and the outputs remain in the previous state. When the clock pulse is high and J = 0 and K = 1, the outputs are changed to Q = 0 and Q = 1. In this condition, the flip-flop is said to be cleared or reset. If the pulse is high and J = 1 and K = 0, the outputs are changed and is known as the set stage. When both inputs are 2 the outputs are placed in a toggle position and Q and Q will alternately change states. The following truth table for a JK flip-flop may help to

Information

explain what happens:

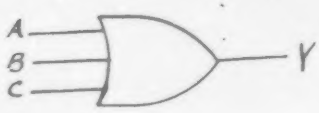
CLK	J	K	Q	Q	
⎍	0	0	No Change		Disabled
⎍	0	1	0	1	Reset Cleared to 0
⎍	1	0	1	0	Set to 1
⎍	1	1	Toggle		On-off- On-off

DIGITAL CLOCKS

A digital clock is used to generate the square waves of a digital system. The clock generates pulses between highs and lows. The astable multivibrator is a reliable clock. Other circuits used to develop square waves are the Schmitt trigger, Schmitt NAND gate (wave shaping circuits) and the 555 timer integrated circuit.

MULTIPLE INPUT GATES

Some logic gates have more than two inputs. These are called multiple input gates. A three input OR gate would be represented by the following logic symbol and truth table:



A	B	C	Y
0	0	0	0
1	0	0	1
0	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1
1	1	0	1
1	1	1	1

Information

The Boolean expression for the multiple input OR gate would be:

$$A + B + C = Y$$

and read: as A or B or C equals Y. This means that if either input gate is closed, the output will be 1.

OTHER LOGIC FAMILIES

Some other logic families include:

RTL	(Resistor-transistor logic)
DTL	(Diode-transistor logic)
TTL	(Transistor-transistor logic)
PMOS	(Positive metal oxide semiconductor)
NMOS	(Negative metal oxide semiconductor)
CMOS	(Complimentary metal oxide semiconductor)

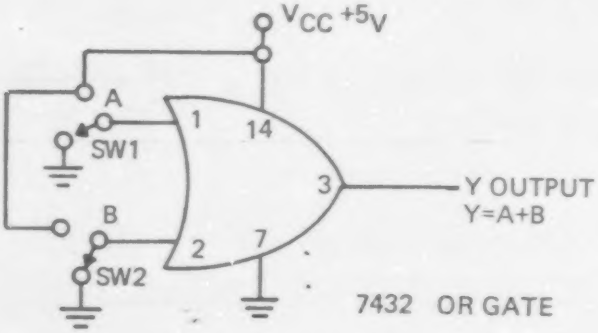
This is only a partial listing of logic families. Each has its own characteristics, such as size and operating speed. Each group is called a family and is not usually interchangeable because of voltage requirements, speed, polarity and pin layout.

Assignment

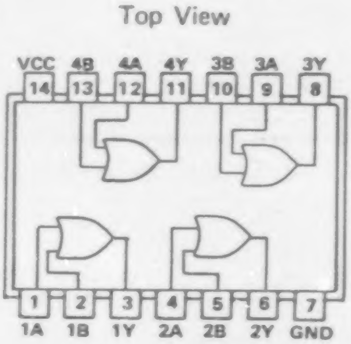
- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment with a score that is satisfactory with the instructor.

Job Sheet

- Construct and test the OR gate circuit shown below:
- Equipment needed
  - SN7432 quadruple 2-input positive OR gates
  - 2-SPDT switches
  - D power supply
  - Multimeter
  - Proto board or equipment for connecting IC's
- Procedures
  - Wire OR gate as shown in diagram
  - Check with multimeter to make sure switches are working
  - Connect multimeter (DC volts) to gate output
  - Move input switches into all possible combinations and record outputs as "1" (high voltage) and "0" low voltage
  - Complete the truth table
  - Compare completed truth table with OR truth table in package



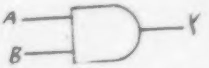
V_{CC} +5V
A
SW1
B
SW2
1
14
3
2
7
Y OUTPUT
Y=A+B
7432 OR GATE

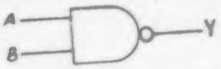


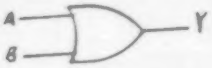
Top View
VCC 4B 4A 4Y 3B 3A 3Y
14 13 12 11 10 9 8
1 2 3 4 5 6 7
1A 1B 1Y 2A 2B 2Y GND

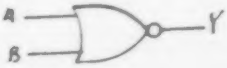
Self Assessment

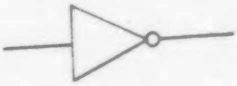
IDENTIFY LOGIC GATES THAT ARE REPRESENTED BY THE FOLLOWING:

1. 

2. 

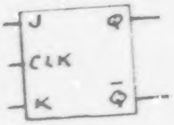
3. 

4. 

5. 

6.

A	B	Y
0	0	1
1	0	0
0	1	0
1	1	0

7. 

8. $A \cdot B = Y$

9. $A + B = Y$

10.

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

Self Assessment Answers

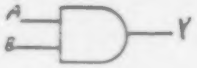
1. AND
2. NAND
3. OR
4. NOR
5. Inverter
6. NOR
7. JK Flip-Flop
8. AND
9. OR
10. OR

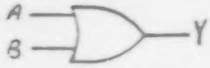
Post Assessment

1. Logic 1 means that the switch is a) open b) closed.

2. A device that translates decimal numbers to binary numbers is an _____________.

3. A device that translates binary numbers into decimal numbers is a _____________.

4. The symbol  shows an __________ gate.

5. The symbol  shows an _____________ gate.

6. The Boolean expression A · B = Y is for the _____________ gate.

7. A truth table that shows is a _____________ gate.

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

8. A logic gate that converts input to its opposite state (1 becomes 0 and 0 becomes 1) is an _____________ gate.

9. The __________ gate is known as the universal gate because it can serve as AND, OR and NOR gates.

10. Logic gates with more than two inputs are called __________ input gates.

Instructor Post Assessment Answers

1. Closed
2. Encoder
3. Decoder
4. AND
5. OR
6. AND
7. AND
8. Inverter
9. NAND
10. Multiple

Supplementary References

Malcolm, Douglas R. Jr., Fundamentals of Electronics. Breton Publishers. North Scituate, Massachusetts, 1983. Pages 311-336.

INSTRUCTIONAL LEARNING SYSTEMS

8.3

DIALERS

Goal:

The apprentice will be able to describe digital and tape dialers and their applications.

Performance Indicators:

1. Describe digital dialers, receivers and programmers.
2. Describe tape dialing equipment.
3. Describe applications of dialers in security alarm field.

Study Guide

- Read the toal and performance indicators. This will give you a clue to what should be learned from the package.
- Read the vocabulary list. This list includes the trade terms that will be used in the package.
- Read the introduction and information sheets to learn technical content.
- Complete the job sheet.
- Complete self assessment and check answers.
- Complete post assessment and ask the instructor to check your answers. This is a good time to ask questions to gain further knowledge on the subject.

Vocabulary

- Acknowledge signal
- Automatic telephone dialer
- Dialer programmer
- Digital communicator
- Digital dialer
- Digital receiver
- Frequency shift keying (FSK)
- Hang up signal
- Programmer
- Program generator
- Receiver/printer
- Tape dialer

Introduction

Existing telephone lines are often the most economical form of signal transmission. The lines can connect the protected area with a central station and response force. If telephone lines were not available, installers would have to string wires from each job to the monitoring station.

Telephone systems offer the best transmission available at this time. The new dialers have added to the efficiency of signal transmission by telephone. This package will deal with both tape and digital dialers.

Information

DIGITAL DIALERS

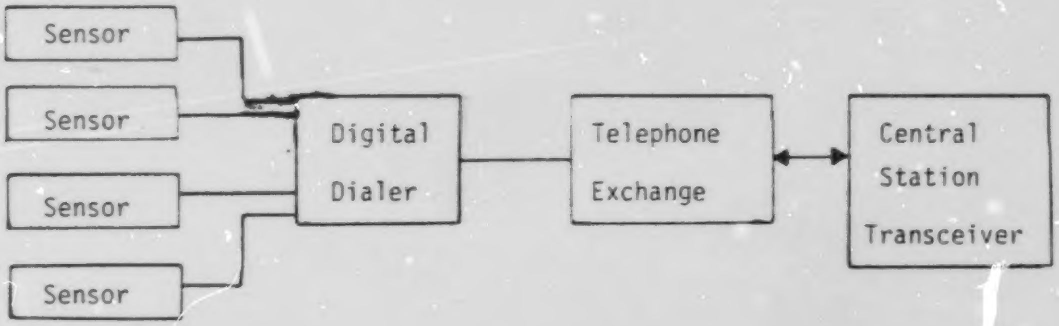
Digital dialers are used for the following purposes:

1. Monitor and report security status of intrusion detectors to the central station.
2. Transmit fire, duress and hold-up alarms to central station.
3. Report facility openings and closings.
4. Monitor equipment sensors for regulating such things as temperature, pressure and humidity.

Digital dialers transmit messages in digital codes. This differs from the old tape dialer which transmits recorded voice messages over the telephone line. The transmission is made by frequency shift keying (FSK). The encoded message is received by a receiver in the central station. The receiver decodes the digital language and displays messages in a format that can be read by the station operator.

Digital dialers are called digital "communicators" because of their two-way communication. One big advantage of digital communications is that they operate on standard phone lines. It is not necessary to install special wire. Digitals are all-electronic which gets rid of the problems with mechanical tape. Reports from digital dialers are usually more accurate than taped voices. Sometimes voice recordings are unclear.

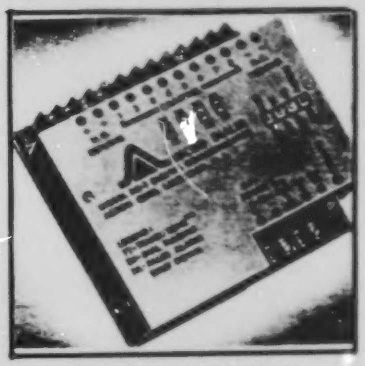
The following diagram shows a digital dialing system:



Information

The dialer sends its message to a matching receiver in the central station. The receiver decodes the digital language and displays the message. The receiver or transceiver sends a message back to the dialer. The receiver tells the dialer that the correct message has been received. Correctness is determined by comparing several messages. This feature adds to the reliability of digital dialers.

Digital communicators provide a two-way communication between the protected area and the central station. The transceiver unit at the central station acts as both transmitter and receiver. Communicators have several operating channels and a test channel. A programmer includes a memory chip which retains information through power failures. The monitoring schedule is pre-programmed into the programmer. A typical digital communicator and programmer are shown below. The specifications for the communicator are included.



DD-1 COMMUNICATOR

DD-1 EIGHT CHANNEL COMMUNICATOR

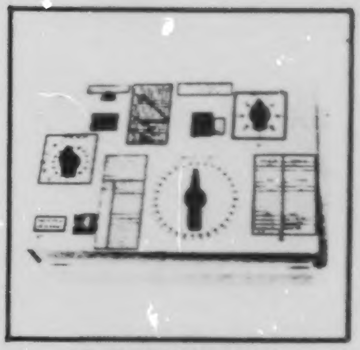
The Acron Model DD-1 Micro-Dialer is an eight channel digital communicator capable of reporting 10 alarm codes when using receivers such as Ademco, DCI, Franklin, Sescoa and Silent Knight. It will operate with any 6 to 12 volt control panel. For silent alarm (stand alone) applications, the DD-1 is available in a locked cabinet. Activation can be from N.O., N.C., or voltage trigger inputs. Once triggered the DD-1 will report all alarm codes.

Dial tone detection and automatic low battery reporting are standard features; a special regulator circuit allows dialer to operate on battery voltages as low as 4.6V.

A total of 13 digits may be dialed. Dialing pauses may be programmed for areas that require access pauses. The telephone number, account number and mode selection are stored in the DD-1 memory chip.

SPECIFICATIONS

F.C.C. Registration Number: AB798Z-67793-AL-E
Ringer Equivalence: 0.1B
Dimensions: 5.7" x 5" x 2"
Housing: Clear finished aluminum
Temp. Operating Range: 35°F to 135°F
Voltage operating range: 4.6 to 16 volts D.C.
Current Consumption/standby: Less than 60 mA
Current Consumption/operate: Less than 90mA
Dial Pulsing Rate (rotary): 10 pps
Make-to-break ratio: 60/40
Touch-Tone dialing rate: 0.1 sec. per digit



DD-1P PROGRAMMER

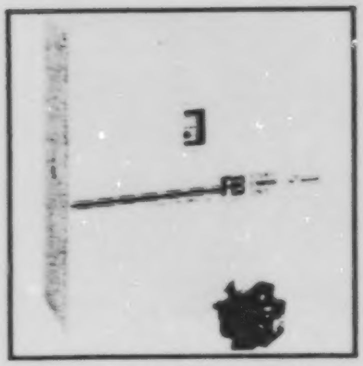
DD-1P PROGRAMMER

The Acron memory chip can be easily programmed using the DD-1 Programmer. A special master chip is not required. Once programmed, information will not be lost during an AC or DC power failure. Minimum programming simply requires telephone number and account number. Additional features such as changing zone numbers, dialing second number, test/cancel, restore codes, delay and listening times and changing from 8 attempts to continuous attempts, can be programmed as needed at no added expense. The memory chip may be reprogrammed up to 4 times. Five control switches and a digital readout are built-in.

BEST COPY AVAILABLE

Information

Digital dialer units can be purchased in many configurations. Some are combined with a control cabinet. A communicator/control combination and its specifications are shown below.



D1270

D1270 COMBINATION CONTROL/COMMUNICATOR

The D1270 combines all the features of the 1270 combination control (see Control Panel Section of this catalog) with the Model 100 Digital Communicator in one specially designed cabinet

Features include fire option, plug-in terminals and bell cut-off system

MODEL 1290 COMPUTER ALARM/COMMUNICATOR

The 1290 features fail safe arming, back-up loop, silent panic, a 12V 200mA regulated output, battery fuse, microcomputer control and an 8 channel digital communicator with multiple program codes

CONTROL PANEL FEATURES
CONTROL PANEL

- Remote Arm or Disarm Multi-Stations
- L.E.D. for Circuit Condition
- L.E.D. System Set
- Uses Standard 501L-L.E.D. Type Remotes
- Instant Loop N.O. or N.C.
- Delay Loop N.O. or N.C.
- Day Loop N.C.
- Adjustable Exit/Entrance Delay
- Adjustable Bell Cut-Off Recycle
- Home/Away Option
- Entrance Pre-Alarm Output
- Bell Output
- Burlgary Spare Contact
- Day Bypass Switch
- Rechargeable or Dry Cell Stand-By Circuit
- Locked Cabinet
- A.C. Light

COMMUNICATOR FEATURES
DIGITAL DIALER

Multiple Code Programming
8 Different codes can be set for the following

1. Fire maintained with restore
2. Fire trouble
3. Burglary with restore
4. Silent panic
5. Open and close
6. Back-Up
7. Maintain or momentary

- Three Telephone Number Capacity
- Auto Receiver Intgerchange
- Up to 4 Digits per Account Number
- Built in Line Seizure
- L.E.D. Transmission Indicator

OPTIONS

- #515 Entry Warning, Day Fire Sonalert
- #666 Remote Reset for Fire
- #1233 Plug In Fire Relay
- #1240 Rechargeable Stand-By Battery 12V 4AMP/HR

SPECIFICATIONS

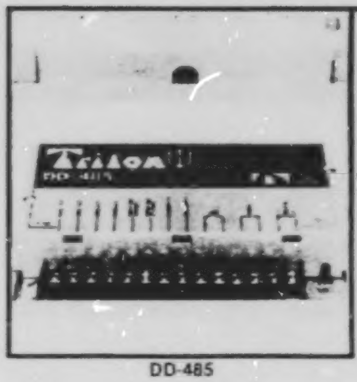
- #1282 - 40VA Transformer
- 3 Amp Fuse - A.C.
- 1 Amp - Battery
- 1 Amp Fuse - 12V 200MA Output (Max)
- 14.0 Volt Charging Circuit
- Spare Contacts Rated at Max. 5 Amps. 115VAC/26VDC
- H 15" L 10.5" D 2.75"

Information

A dialer may be combined with a programmer. One communicator/programmer unit and its specifications are shown below.

"TRITON" DIGITAL COMMUNICATOR AND PROGRAMMER

SPECIAL FEATURES AND SPECIFICATIONS



DD-485

"TRITON" DD-485 FOUR CHANNEL COMMUNICATOR

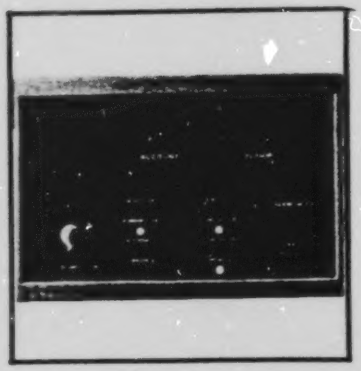
- **4 Zones** — Voltage and dry contact closure activation
- **Compatible With All Popular Digital Receivers**
- **Memory Chip Programming** — No wires to cut or nuts to rearrange. Codes cannot be visually deciphered
- **Communicates With Up To 3 Different Telephone Numbers In a Variety of Dialing-out Sequences**
- **True Dial Tone Detection**
- **2 Wire Line Seizure**
- **6-18 Volt Filtered DC Operation**
- **Low Current Draw** — 30 microamps inactive, 150 milliamps active
- **Rugged ABS Plastic Case** — (4-¾ x 7 x 1-3/8) with snap-in protective terminal cover. Optional metal cabinet available.

PROGRAMMABLE FEATURES

- **Restore Reporting:** Each zone can be programmed for its own single digit code which is sent if the zone's activation input is removed after the unit has dialed-out.
- **Low Battery Reporting:** After zone activation is removed, the unit checks its power input. If this is low, it dials out to send a selectable single digit code.
- **Alarm Abort:** Allows the transmission to be stopped if the unit has been restored before a dial-out has been completed.
- **Zone Trip Delay:** A delay from 1 second to 4¾ minutes can be programmed for any zone.
- **Ring Back/Test:** After a successful transmission the unit will sound an optional "Sonalert" (for a programmable length of time) once "kiss-off" is received from the central station.
- **3 or 4 Digit Account Codes.**
- **Alarm Codes:** Choose any single digit code for each zone.
- **11 Digit Access Number:** Sometimes needed to reach an outside telephone line.
- **Up to 3 Separate Telephone Numbers:** (of up to 11 digits each) can be contacted.
- **Choice of Dial-out sequences:** Sequence selection and number of dialing attempts are fully programmable.
- **Normal Mode:** The communicator will try to get through to one of two telephone numbers.
- **Emergency Mode:** The communicator will try to get through to one of three telephone numbers.
- **Double Report Mode:** The communicator will try to get through to two of three telephone numbers. This mode is ideal for reaching two separate central stations.
- **Select Mode:** Activation of zones I and II will trigger an emergency message to be sent to one telephone number, while activation of zones III and IV will trigger a transmission to a second, separate telephone number.
- **Combination Select/Emergency Mode:** This combines the features of the two modes.
- **Combination Select/Double Report Mode:** This combines the features of the two modes.

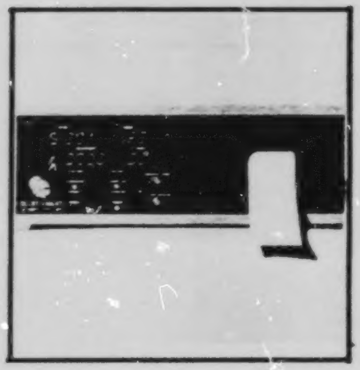
Information

Digital receivers must be compatible with the digital dialer. The receiver answers incoming calls and sends an "acknowledge" signal back to the dialer. The receiver compares sets of coded messages from the dialer. When satisfied that the message is valid, the receiver transmits a "hang-up" signal to the dialer. Some receivers have hard copy printers attached. Photographs of a digital receiver and a receiver/printer are shown. Specifications for the two receiving units are included.



8510 DIGITAL RECEIVER

POWER: Operates on 117 VAC. Provision for external battery power supply.
POWER CONSUMPTION: 20 watts.
DIMENSIONS: 8¾" x 6" x 13" (22.2 x 15.2 x 33 cm).
SHIPPING WEIGHT: 17 lbs. (7.71 kg.).



8520 DIGITAL RECEIVER/PRINTER

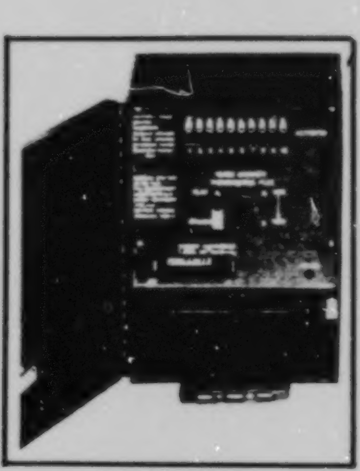
POWER: Operates on 117 VAC. Provision for external battery power supply.
POWER CONSUMPTION: 30 watts.
DIMENSIONS: 17½" x 6" x 13" (44.5 x 15.2 x 33 cm)
SHIPPING WEIGHT: 25 lbs. (11.34 kg.)

TAPE DIALERS

The tape dialer is called a voice dialer that is used on standard telephone lines. The dialer uses an endless loop of sudio recording tape. The telephone number of the monitoring station is pre-recorded by tone pulses. The number is followed by voice messages. When an alarm system trips, the dialer starts running the tape. The tone pulses dial the number of the monitoring station. The alarm is given as a pre-recorded voice message.

Information

A photograph and specifications of a typical tape dialer is shown below. The tape dialer is also called an automatic telephone dialer.



310

MODEL 310 AUTOMATIC TELEPHONE DIALER

• Dual Channel • Channel 2 Priority • Line Seizure • Anti-Jam Programming • Plug-in Components • Dry Closure or 6-12 Volt Activation on Both Channels • Field Programming • Endless Loop Cassette — 6 Min. (Eliminates Threading Problems) • Momentary Test Switch: Eliminates Test Errors & Accidentally Leaving Unit in Off or Test Mode • Unit Activated L.E.D. Indicator • Extremely Inexpensive Telephone Style Programmer • Solenoid Engages Pinch Roller when Unit is Activated (Eliminates Tape Sticking & Jamming) • Tape Head Stop Mechanism • Supervisory Time-Out Circuit (Eliminates Runaway Dialing) • Unique Momentary Test Switch: Ensures Connection to Telephone Network • Actual Audio Message & Dial Clicks Heard on Home Phone • Unit Returns to On-Line Only After Test Cycle is Completed . . . Even if Home Phone is Back on Receiver • Tape and Transformer Included.

SPECIFICATIONS

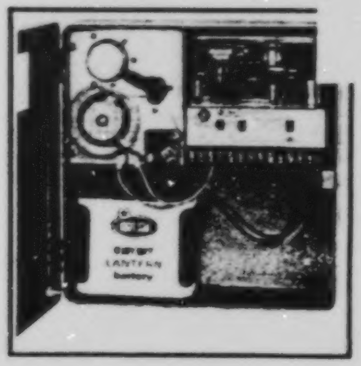
• 1271-20 VA Transformer • 3 AMP Fuse • Total Current Operating 750 MA • Total Current Stand-by Zero

ACCESSORIES

311	Coupler Power Supply and Interface.
312	AC/DC Power Module with plug-in power supply.
312R	AC/DC Power Module with charging circuit. Plug-in power supply, and rechargeable stand-by battery, 4 amp/hr.
313	Coupler cord.
315	Blank tape (12 min.).
316	Blank tape (6 min.).
317	Programming for tape (6 min.).
319	Line Cut Detector, 6 or 12V. California Public Utilities Comm. Registration #0258.
320	Telephone Style Programmer for 310 dialer, includes Microphone.
321	Bulk Eraser, for clearing used tapes.
322	Blank Tape Cartridge for ATA Dialers only.
368	Connector Cord, FCC Approved for use with RJ31X telephone jack (7').
461	Hold-up Oscillator (special applications).

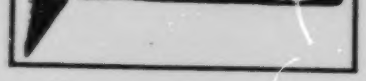
Information

The tape dialer also comes in many configurations. Some have a combination dialer and programmer. Such a combination and its specifications are shown below.



- Two Channels — Burglary & Fire
- Built-in Test Speaker with Test Switches for Each Channel
- Activates from N.O. Contacts or D.C. Impulse
- Can Be Set So That Local Control Aborts Dialer
- Operates from a 6 Volt Battery

Separate programmers or program generators are available. Photographs of two types of programmers are shown.



Information

One problem with this type of dialer is the tape transport system. If it is not used for a period of time, the tape may stick and cause problems.

Assignment

- Read pages 219 - 223 in supplementary reference.
- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Job Sheet

ANALYZE DIGITAL AND TAPE DIALER SYSTEMS.

- Visit sites that use each of the dialer systems.
- Ask the monitor of the system to explain how it works.
- Construct a flow chart of a digital dialer system from sensors to response force.
- Construct a flow chart of the tape dialer system.
- Identify how:
  - Dialer is connected with sensors.
  - Dialer is connected with phone service.
  - Receiver is connected with phone service.
  - Receiver displays information.

Self Assessment

1. List 3 purposes served by digital dialers.

2. ______________ dialers transmit voice messages that have been pre-recorded.

3. The ________________ receives and decodes messages sent by the dialer.

4. Digital dialer systems offer ____________ way communication between protected area and monitoring station.

5. Why is the tape transport system of a tape dialer a problem?

Self Assessment Answers

1. Monitor and report security status. Transmit fire, duress and intrusion signals to the central station. Report facility openings and closings. Monitor equipment sensors.
2. Tape
3. Receiver
4. Two
5. Because of long periods of disuse. The tape may stick.

Post Assessment

1. List two configurations of digital communicators.

2. Digital codes from the communicator is decoded in the ____________________.

3. Which is the most reliable -- digital or tape dialers?

4. List two configurations of digital receivers.

5. Why is the digital dialer called a communicator?

Instructor Post Assessment Answers

1. Combination control unit/ communicator / dialer / programmer

2. Receiver

3. Digital

4. Receiver / printer

   Receiver

5. Because the receiver can communicate back to the dialer.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981. Pages 219-223.

INSTRUCTIONAL LEARNING SYSTEMS

9.1

BLUEPRINT READING BUILDING MATERIALS AND SYMBOLS

Goal:

The apprentice will be able to identify building materials used in construction by reading blueprints.

Performance Indicators:

1. Recognize drawing symbols for common building materials.
2. Recognize common symbols of a plumbing plan.
3. Recognize common symbols of an electrical plan.
4. Recognize common symbols of an air-conditioning plan.
5. Recognize topographical symbols of a plot plan.
6. Read dimensions on drawings and blueprints.

Study Guide

- Study the goal and performance indicators to find what is to be learned from package.
- Read the information sheets.
- Complete the reading assignment for further information on wall and ceiling framing details.
- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Vocabulary

- Air conditioning plans
- Detail sections
- Electrical plan
- Elevations
- Floor plan
- Plot plans
- Specifications
- Survey plan
- Topographical symbols

Introduction

Blueprints show details of construction and the types of materials used in construction. A minimum set of builidng plans consist of floor plans, front elevation, right elevation, survey plan and a full section of the building. A maximum set of plans includes many other plans such as landscape, air conditioning, electrical and plumbing plans.

An installer should be able to read the symbols for various types of building materials. When making decisions on microwave applications, for instance, it is important to know what the walls are made from. Installers must drill holes in walls to string wire for alarm systems. The blueprints will show what lies underneath the plaster.

Information

SETS OF PLANS

Plan sets for modern buildings aremade by professional architects. The number of plans in a set depends on the degree to which the designer wishes to control the construction of a building. An average set of plans includes:

- Floor plan
- Front elevation
- Rear elevation
- Right elevation
- Left elevation
- Interior elevations
- Plot plan
- Survey plan
- Full section
- Detail sections
- Electrical plan

All of these drawings can be helpful to the installer in planning space and volumetric detection systems. The plot plan can be used in planning outdoor and perimeter security systems.

SPECIFICATIONS

Many plan sets include material specifications. Specifications show materials to be used in each part of the building and the exact dimensions of each of the items. A set of specifications is listed as a table.

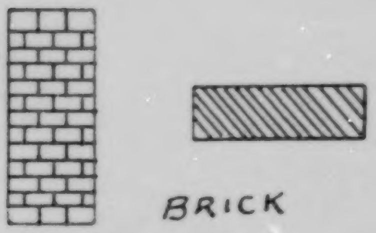
Line No.	Item No.	QUANTITY	MATERIAL	UNIT COST	TOTAL COST
1	Ceiling Framing	150 pieces	2" x 6" x 12' Joists		
2	Roof Framing		2" x 6" x 16' Rafters		
3					

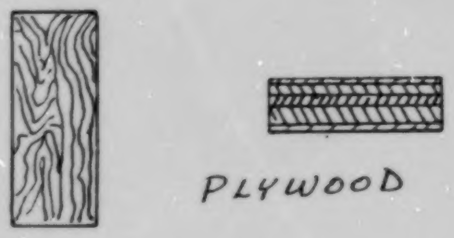
Information

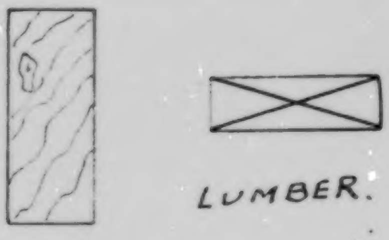
Specifications can be used in cases where the plan is not clear to the reader.

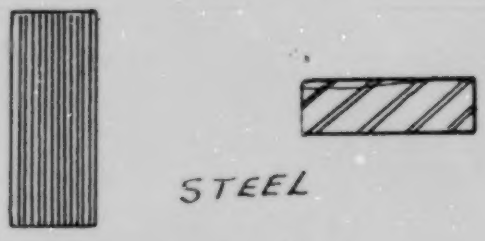
SYMBOLS

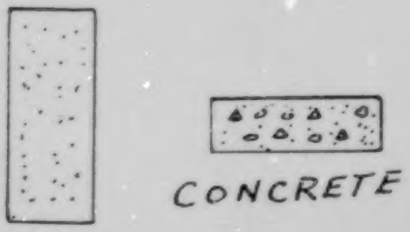
Each type of building material has its own symbol. In order to read plans and blueprints, the reader must know common symbols by sight. Materials symbols will appear one way in an elevation drawing and in another way in a section drawing. Elevation drawings show the side of a building from top to bottom. Sections show a building as though it has been sawed in half. The section shows the exposed cross-section after it has been sawed. The symbols for common building materials in both elevations and sections are shown below.

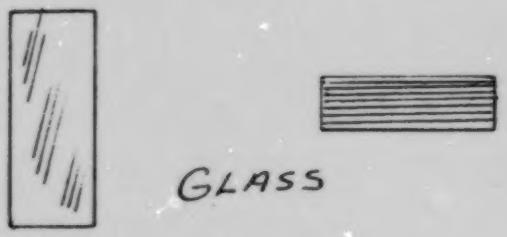

BRICK


PLYWOOD


LUMBER.


STEEL

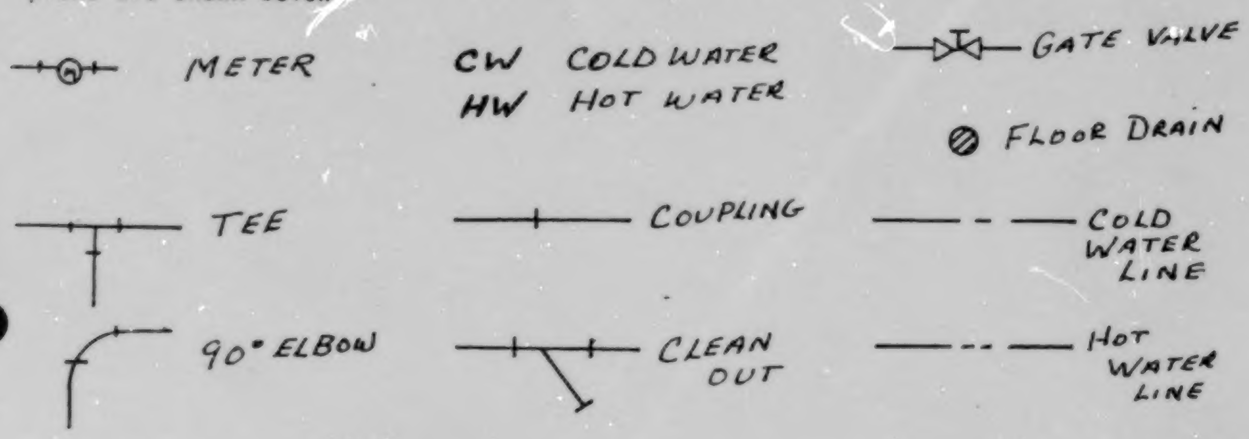

CONCRETE


GLASS

Information

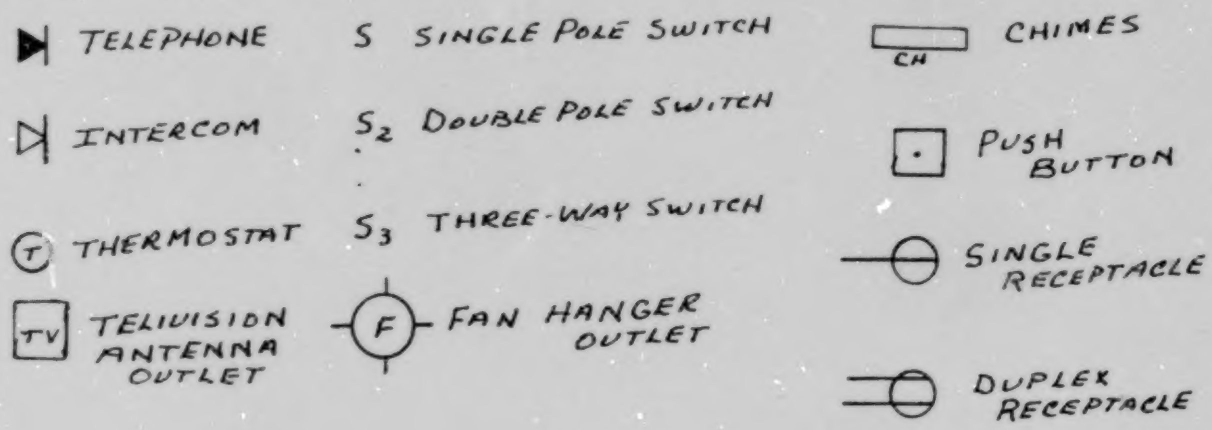
PLUMBING SYMBOLS

An installer should have some knowledge of plumbing plans. The symbols for plumbing plans are shown below.


METER
CW COLD WATER
HW HOT WATER
GATE VALVE
FLOOR DRAIN
TEE
COUPLING
COLD WATER LINE
90° ELBOW
CLEAN OUT
HOT WATER LINE

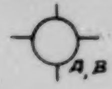
ELECTRICAL SYMBOLS

Electrical symbols of an architectural plan are somewhat different from those used in the block diagrams and schematics of electronics plans. The common electrical symbols are shown below and on the next page.

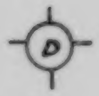

TELEPHONE
S SINGLE POLE SWITCH
CH
CHIMES
INTERCOM
S2 DOUBLE POLE SWITCH
PUSH BUTTON
T
THERMOSTAT
S3 THREE-WAY SWITCH
SINGLE RECEPTACLE
TV
TELIVISION ANTENNA OUTLET
F
FAN HANGER OUTLET
DUPLEX RECEPTACLE

Information

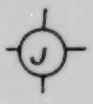
ELECTRICAL SYMBOLS (Continued)



SPECIAL FIXTURE OUTLET



DROP CORD FIXTURE

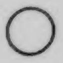


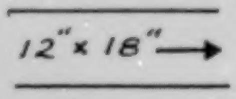
JUNCTION BOX

S_{WP} WATERPROOF SWITCH

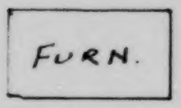
AIR CONDITIONING SYMBOLS

Air conditioning systems influence some types of detection devices. The installer should know the common symbols for air conditioning systems.

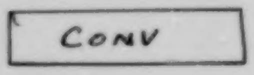

CEILING DUCT OUTLET



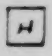
DUCT SIZE AND AIR FLOW



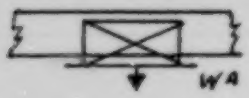
FURNACE



CONVECTOR



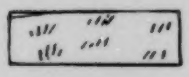
HUMIDISTAT

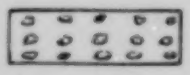


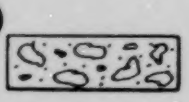
WARM AIR SUPPLY

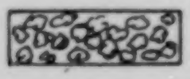
TOPOGRAPHICAL SYMBOLS

Plot plans use topographical symbols to show natural and man-made features of outside areas. The plot plans can be very useful in planning outdoor detection systems. The plot plans show trees, power lines, railroad tracks and roads that may interfere with some types of intrusion detectors.


TALL GRASS

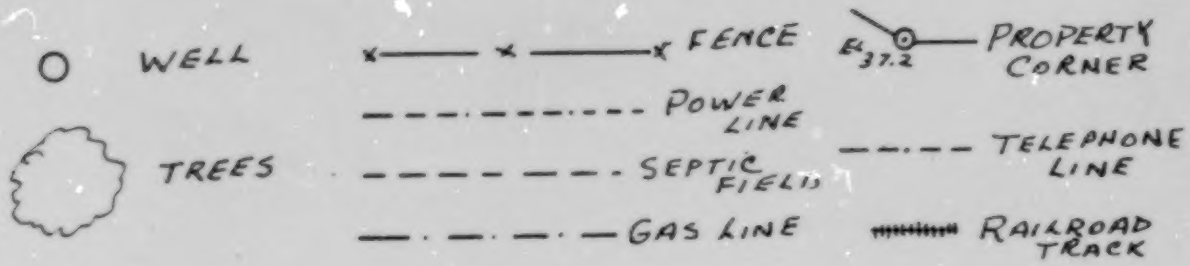

ORCHARD


LARGE STONES


DENSE FOREST

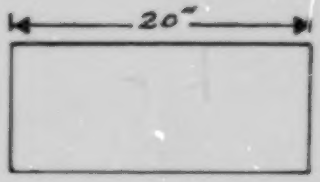
Information

TOPOGRAPHICAL SYMBOLS (continued)


WELL
FENCE
EL 37.2
PROPERTY CORNER
POWER LINE
TREES
SEPTIC FIELD
TELEPHONE LINE
GAS LINE
RAILROAD TRACK

DIMENSIONS

Dimensions are shown with dimension lines. A dimension line has an arrow at each end.



Distances can be calculated from plans by reading the dimensions on the plans. Detection coverage patterns can be planned from the blueprints. The length of wire runs and locations of sensors and processors can be planned in advance.

APPLICATIONS

Blueprint reading is a critical skill for low voltage installers. They do not need to be architects or drafters. The installer must be able to interpret the work of architects. This requires the installer to know the common symbols used in drawings and how to read the dimensions shown on the blueprints. With some basic knowledge of symbols and dimensioning, the installer can become a good blueprint reader through job experience.

Assignment

- Read Chapter 12--Wall and Ceiling Construction, pages 209 - 221 in *Architecture Residential Drawing and Design*. Kicklighter and Baird. Goodheart-Willcox Company, Inc. South Holland, Illinois. 1979.
- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and check answers with instructor.

Job Sheet

ANALYZE A COMPLETE SET OF PLANS

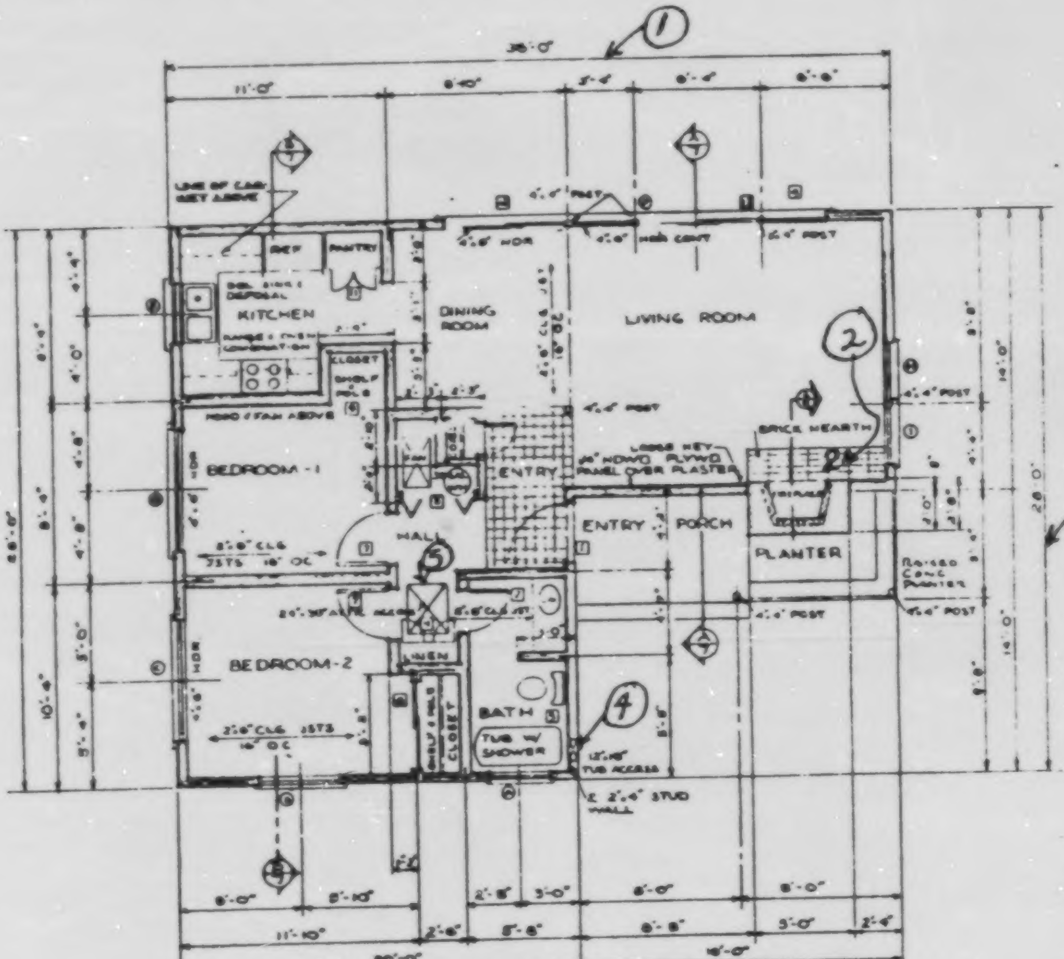
- Secure a set of blueprints for a commercial or residential building.
- Examine each plan in the set.
  - What kind of plan is it?
  - What is the purpose of the plan?
  - Which symbols do you recognize?
  - Which symbols do you fail to recognize?
  - Can you understand the dimensions of the plan?
- Make a list of symbols and other plan features that you do not understand.
- Ask you instructor to explain those features that you do not understand.

Self Assessment

Study the following plan.

1. What type of plan is it?

Identify what the plan shows at the following points:


①
②
③
④
⑤
KITCHEN
PANTRY
DINING ROOM
LIVING ROOM
BRICK HEARTH
ENTRY
ENTRY
PORCH
PLANTER
HALL
BEDROOM-1
BEDROOM-2
LINEN
CLOSET
BATH
TUB W/ SHOWER
36'-0"
28'-0"
11'-10"
20'-0"
16'-0"

Self Assessment Answers

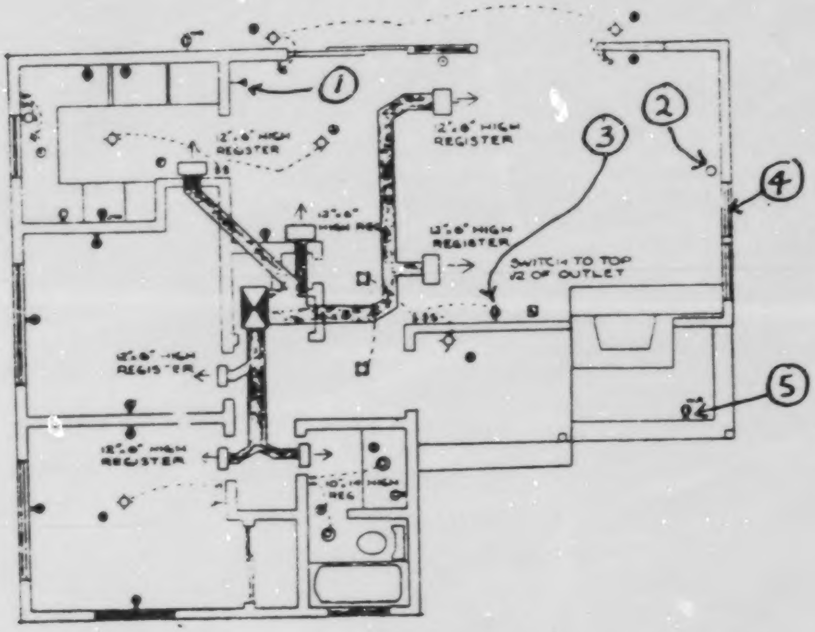
1. Total length of house
2. Brick fireplace hearth
3. Total width of house
4. Tub access
5. Attic access

Post Assessment

Study the following plan.

1. What type of plan is it?

Identify what each of the symbols represent. Numbers are marked on the plan.


1
2
3
4
5
12" x 6" HIGH REGISTER
12" x 6" HIGH REGISTER
12" x 6" HIGH REG
12" x 6" HIGH REGISTER
SWITCH TO TOP 1/2 OF OUTLET
12" x 6" HIGH REGISTER
12" x 6" HIGH REGISTER
10" x 4" HIGH REG

BEST COPY AVAILABLE

Instructor Post Assessment Answers

1. Electrical and heating

2. Telephone

3. Ceiling duct outlet

4. Duplex receptacle

5. Window

6. Weatherproof duplex receptacle

Supplementary References

- Kicklighter, Clois E. and Baird, Ronald J. Architecture Residential Drawing and Design. The Goodheart-Willcox Company, Inc. South Holland, Illinois. 1979.

INSTRUCTIONAL LEARNING SYSTEMS

9.2

DESIGN OF ALARM SYSTEMS

Goal:

The apprentice will be able to design a basic home or commercial alarm plan.

Performance Indicators:

1. Identify zones of detection.
2. Identify sensor devices for each zone of detection.
3. Sketch alarm system on plot and floor plan.

Study Guide

- Read the goal and performance indicators. This tells you what can be expected from the package.
- Read the vocabulary list. The vocabulary list will show you the trade terms to be used in the package.
- Read the introduction and information sheets for technical content.
- Complete the job sheet for practice in designing a system.
- Complete the self assessment to see how much you have learned. Check your own answers.
- Complete the post assessment to show your instructor how much you have learned. Have instructor check answers.

Vocabulary

- Asset location
- Asset value
- Deterrants
- Exterior zone
- Field detectors
- Floor plans
- Motion detectors
- Perimeter penetration zone
- Plot plans
- Proximity detectors
- Stress detectors
- Structural barriers
- Threat analysis
- Transducers
- Zones of detection

Introduction

Design of alarm systems involves many considerations. The designer must know what threatens the property and methods for detecting intrusion. Such design involves paper and pencil drawings of floor plans and plot plans. In some cases construction blueprints are available to the installer. Sometimes installers will have to draw their own plans.

The design is much easier if the total system is broken into zones of detection. This allows the designer to deal with small pieces of a system at one time. When the small pieces are tied together, it is the design for a total security system. The zones of detection become organizers for the design of intrusion detection systems.

Information

USE OF BLUEPRINTS, DRAWINGS AND PLANS

When designing home alarm systems, the installer should have a basic floor plan. The floor plan shows doors, windows, hallways and many other features of a home.

If outdoor detection is to be included, a plot plan will be needed. A good plot plan shows distances, trees, shrubs, entrance ways and fences.

Detailed plans and specifications such as electrical and air conditioning plans will be needed for commercial and industrial jobs. For home protection, the floor plan and plot plan should be sufficient for designing a system.

If drawings are not available, the installer should take measurements and sketch a floor plan as plot plan. Some type of plan is needed for laying out the design of the system.

CONSIDERATIONS IN DESIGN

Several considerations should be given to the design of an alarm system.

1. Threat analysis -- What is the nature of the threat to the property to be protected?

2. Assest value -- What is the value of the items to be protected?

3. Location of assets -- Where are the valuables located within the protected areas?

4. Structural barriers -- What types of barriers exist between a burglar and the protected items? Fences, walls, roofs, floors and vaults are examples of structural barriers.

5. Operable openings -- How many openings or access points does the intruder have for entering the house?

6. Deterrants -- What types of deterrants now exist? Neighborhood watch, security patrols and watchdogs are examples of deterrants.

ZONES OF DETECTION

The zones of detection must be determined. Some systems may start at the property line fence which is the first zone of detection. Other systems may start at the building walls which is the third zone of detection. The designer must decide where detection should begin. It will depend on the threat, asset value and the other

Information

considerations of design. The five zones of detection are:

Zone 1 -- Perimeter penetration such as crossing the boundary line.

Zone 2 -- Exterior zone such as walking across the yard.

Zone 3 -- Perimeter of building such as breaking through walls, doors and windows.

Zone 4 -- Interior of building outside the room where the protected item is stored.

Zone 5 -- The protected item such as a safe, file cabinets or antique collection.

CHOICE OF DETECTION DEVICES

The selection of sensor devices is determined by the zones of detection. The zones of detection and sensor devices are listed below:

Zone 1 -- Perimeter penetration

- Electric field sensors
- Transducers (geophone, piezoelectric, electro-mechanical)
- Electret cable transducer
- Strain-magnetic line sensors
- Taut wire switches

Field detectors
Stress detectors

Zone 2 -- Exterior

- Buried line sensors
- Infrared beam
- Microwave beam

Field detectors
Beam detectors

Zone 3 -- Building perimeter

- Foil tape
- Grid wire
- Vibration detector
- Glass breakage detector
- Magnetic door switches

Stress detectors

Information

Zone 4 -- Building interior

- Passive infrared
- Audio
- Ultrasonic
- Sonic
- Microwave

Motion detectors

Zone 5 -- Protected item

- Pressure mats
- Capacitance sensors
- Vibration detectors
- Tilt switches

Proximity detectors

DESIGNING THE SYSTEM

1. Determine where detection should begin (Zone of detection).
2. Select most appropriate devices for each zone.
3. Determine the number of sensors needed in each zone of detection.
4. Sketch wiring layout from sensors to signal processors.
5. Consider environmental factors that may affect each type of sensor. Rain, snow, flying birds and street traffic have an effect on many sensors. Early consideration of this may avoid false alarms.

FIRE ALARM SYSTEM DESIGN

Fire alarm systems are designed to alert people that a fire is under way. The design of fire alarms is much different than that of an intrusion alarm system. A fire alarm system must consider:

1. Sensors, usually smoke detectors, placed in or near sleeping areas.
2. Sensors placed in duct system.

The choice of sensors for home installation is simple. The smoke detector gives earlier warnings than the flame detectors or thermal detectors. Most systems use a smoke detector that works on the principle of ionization.

Assignment

- Scan information in pages 1 - 51 of the supplementary reference. Read material that is needed to complete your background knowledge of design philosophy and requirements.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete post assessment and have the instructor check answers.

Job Sheet

PLAN ALARM SYSTEM FOR YOUR OWN RESIDENCE

- Materials
  - Butcher paper
  - T square or rules
- Draw a floor plan for your residence. Include doors, windows, and room dimensions.
- Plan an intrusion alarm system for Zones 3, 4 and 5.
- List your selection of intrusion sensors for each detection zone.
- Show location of control unit.
- Show how system will be monitored.

Self Assessment

LIST DETECTION DEVICES THAT ARE APPROPRIATE TO THE ZONES OF DETECTION

1. Zone 1

2. Zone 2

3. Zone 3

4. Zone 4

5. Zone 5

6. List two examples of deterrants.

7. What type of drawing is needed for planning exterior detection?

8. What type of plan is needed for planning zone 3, 4 or 5 detection?

9. What is a threat analysis?

10. What type of fire detector is most widely used in homes.

Self Assessment Answers

1. Electric field sensors, transducers (geophone, piezoelectric, electro-mechanical, electret cable) taut wire switches, strain-magnetic sensors.

2. Buried line sensors, infrared beam, microwave.

3. Foil tape, grid wire, vibration detectors, glass breakage detectors, magnetic door switches.

4. Motion detectors (passive infrared, audio, sonic, ultrasonic, microwave).

5. Pressure mats, capacitance sensors, vibration detectors, tilt switches.

6. Watchdogs, security patrol, neighborhood watch.

7. Plot plan

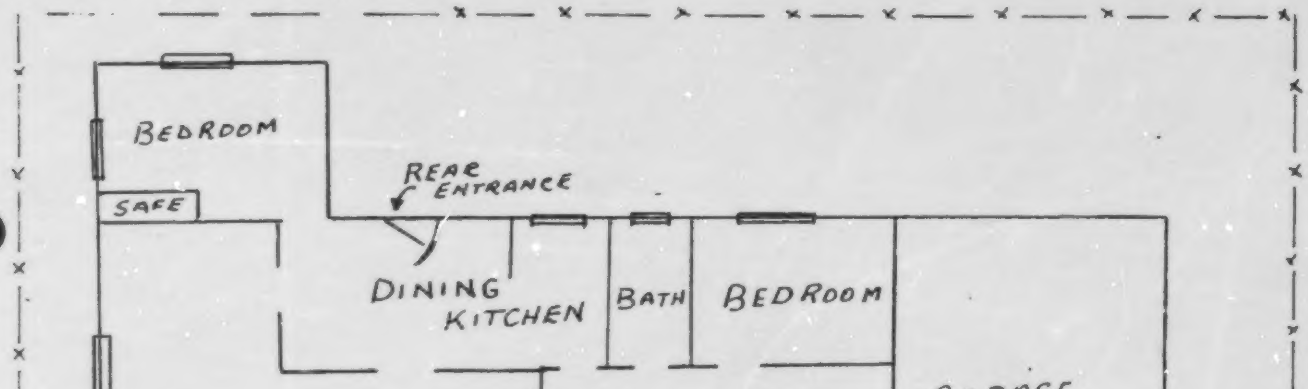
8. Floor plan

9. Determine the level of threat to life and property

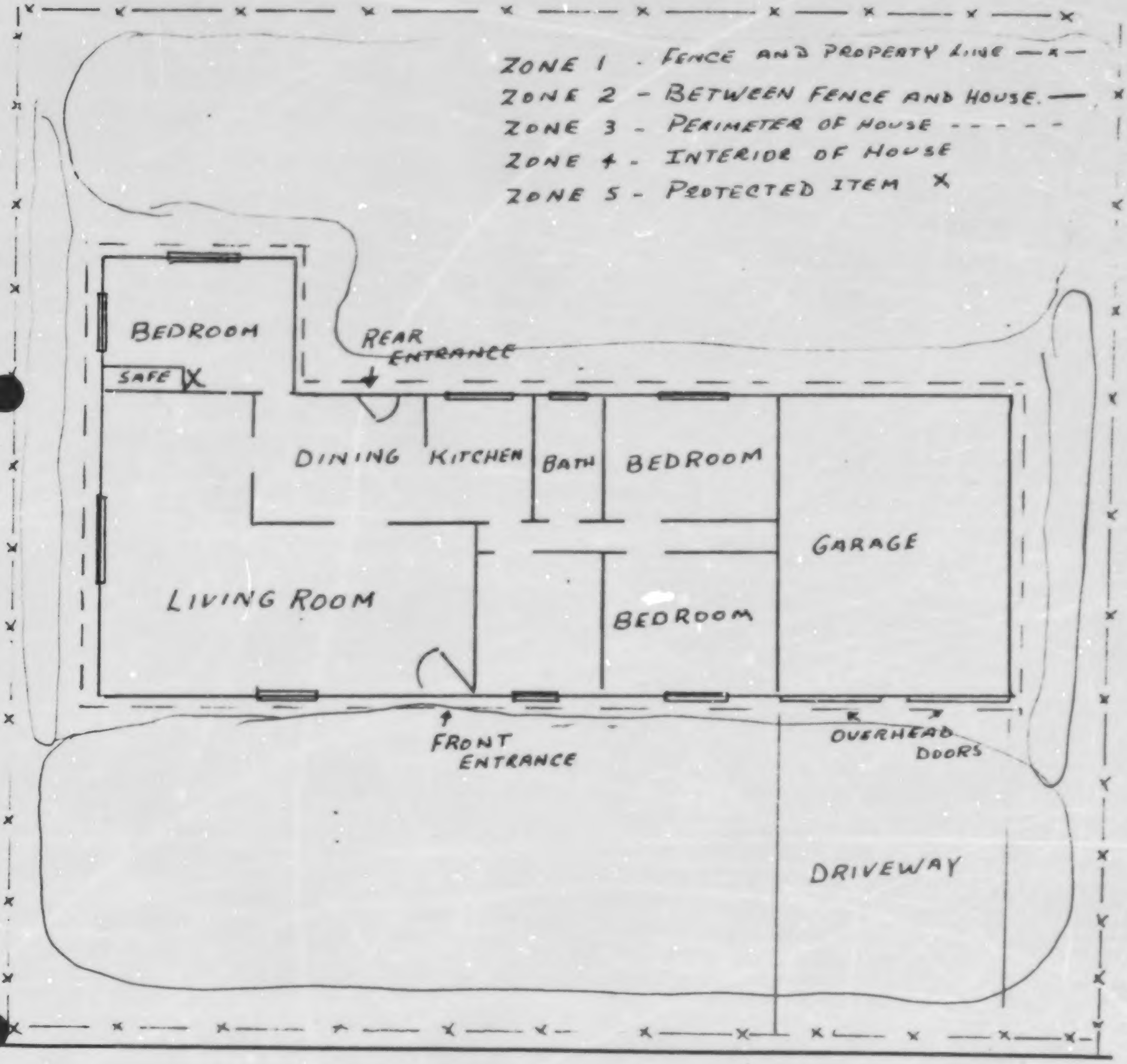
10. Ionization smoke detector

Post Assessment

- On the following plan, mark the zones of detection in red pencil. Remember there are five.
- List two types of sensors that might be used in protecting each zone.


BEDROOM
SAFE
REAR ENTRANCE
DINING KITCHEN
BATH
BEDROOM
GARAGE
LIVING ROOM
OFFICE
BEDROOM
FRONT ENTRANCE
OVERHEAD DOORS
DRIVEWAY

Instructor Post Assessment Answers


ZONE 1 - FENCE AND PROPERTY LINE —x—
ZONE 2 - BETWEEN FENCE AND HOUSE —
ZONE 3 - PERIMETER OF HOUSE - - - - -
ZONE 4 - INTERIOR OF HOUSE
ZONE 5 - PROTECTED ITEM X
BEDROOM
SAFE
REAR ENTRANCE
DINING
KITCHEN
BATH
BEDROOM
GARAGE
LIVING ROOM
BEDROOM
FRONT ENTRANCE
OVERHEAD DOORS
DRIVEWAY

Supplementary References

- Barnard, Robert L. Intrusion Detection Ssytems: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981. Pages 1 - 51.

iLS

INSTRUCTIONAL LEARNING SYSTEMS

10.1

TYPES AND APPLICATIONS OF ALARM SYSTEMS

Goal:

The apprentice will be able to describe the types and applications of alarm systems.

Performance Indicators:

1. Describe main parts of a security alarm system and their functions.
2. Describe a hard-wired system.
3. Describe open and closed circuits.
4. Describe armed and unarmed systems.
5. Describe common devices used in detectors and their use.

Study Guide

- Read the goals and performance indicators to determine what you are expected to learn from this package.
- Read the information sheets.
- Review vocabulary sheet to make sure that you understand the meaning of terms.
- Complete self assessment and check answers with the answer sheet.
- Complete post assessment and ask instructor to score answer.

Vocabulary

- Armed system
- Bullet-nosed sensor
- Cable
- Closed circuit
- Control unit
- Detector
- Disarmed system
- Hard-wired system
- Open circuit
- Power supply
- Pressure sensitive matting
- Reed and magnet switch
- Tamper switch
- Vibration switch

Introduction

Most alarm systems are designed to protect life and property. The major uses of alarm systems are:

- Bank alarms to protect the bank's money from robbery and theft. Bank security has been a problem for several hundred years.
- Fire alarms to protect buildings and homes from being destroyed.
- Burglar alarms to protect property from being burglarized.

Alarm systems are also used to control work processes and add comfort to life.

- Environmental conditions of buildings are monitored from remote stations.
- Movement of oil in the Alaskan pipeline is monitored by a highly complex alarm system.
- Supermarket doors open for the customer through the use of invisible beams of light.
- Industry uses alarm devices in controlling their manufacturing processes.

This package will introduce apprentices to alarm systems. Other packages will be devoted to the specifics of the different systems.

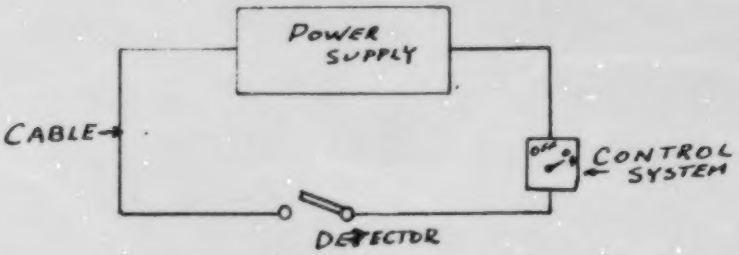
Information

Security alarm systems range from simple to very complex devices. All alarm systems have four main parts:

1. Power supply
2. Control system
3. Detector unit
4. A means to connect the units such as calbe in a hard-wired system

Alarm systems may be operated by electricity, beams of light, radio signals and magnets.

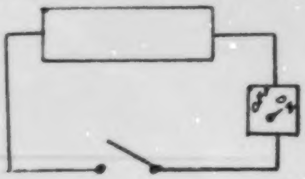
A hard-wired system is one in which wires are used to connect the main parts of the system. A basic alarm system is shown in the following drawing.



Hard-wired alarm systems may be connected as:

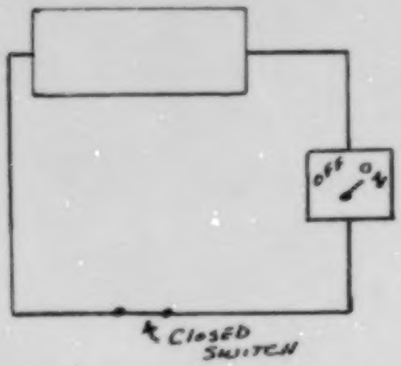
1. Normally open circuits
2. Normally closed circuits

A normally open circuit is armed with the switch in the open position. An alarm goes off when the switch is closed.



Information

A normally closed circuit is armed with a closed detector switch. The alarm goes off when the switch is opened.



POWER SUPPLY

The power supply for many alarm systems is household electricity. This electricity must be modified by transformers, rectifiers and filters into low voltage D.C. The power supply units have built-in electrical components for providing the proper voltage. Most systems have batteries as a back-up system in case the regular power supply is shut off.

CONTROL SYSTEM

The control unit is the "guts" of all alarm systems. Wires reach out from the control unit to all detector units. The control unit relays signals from the detector to the alarm. Quite often, the control unit will have its own security system to make sure that it is not tampered with. Tamper switches are placed in the control units. If the unit is bothered, the alarm will go off. When a system is set to go, it is "armed". When the system is turned off, it is disarmed. A key is used to arm and disarm the system. In most systems, a green light shows whether the system is armed.

CABLE SYSTEMS

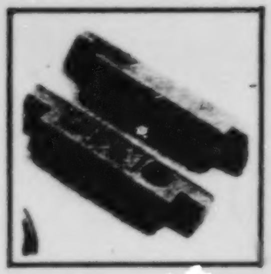
The cable used in "hard wired" systems usually contains two wires. This cable connects the main parts of the system and carries electrical current for operating the system.

Information

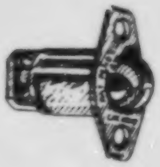
DETECTOR UNITS

There are hundreds of types of detector devices. Some are operated by radio signal, magents and light beams. The different types of detectors will be covered in other learning packages. A sample of common detection devices will be discussed in this package. This discussion will acquaint apprentices with some of the commonly used switches for household and office security alarms.

Reed and magnet switches are used on windows and doors. One part of the switch is attached to the door frame and the other to the door. Reed and magnet switches are usually wired in a closed circuit. The alarm sounds when the door is opened.

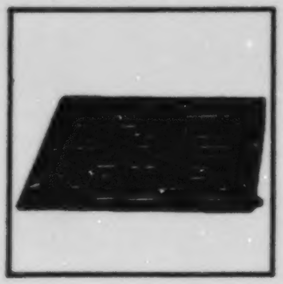


Bullet nosed sensors are used on doors and windows. The system is armed with the "bullet nose" of the switch pressed against a closed window or door. When the door opens, the alarm sounds.



Information

Pressure sensitive matting is used underneath rugs. This material can also be buried in soil beneath windows. When an intruder steps on the pressure sensitive matting, their weight will close the circuit and sound an alarm.



NOS. 159/160/161 SEALED SUPER-THIN MATS

Stock size mats • Super thin construction • Only 3/32'' thick • Available in three sizes: 18'' x 24'', 18'' x 30'', 6'' x 23'' • Designed for under carpet use • Perfect for hard to protect areas • Rugged vinyl cover • Completely sealed and moisture resistant

No. 159	Super-Thin Mat, 18'' x 24''
No. 160	Super-Thin Mat, 18'' x 30''
No. 161	Super-Thin Mat, 6'' x 23''

Vibration switches are used to trigger alarms when intruders break the glass in windows or doors. The shock waves are picked up by a sensor in the vibration switch which completes the alarm circuit.

NO. 11

NO. 11 VIBRATION CONTACT

Ademco Vibration Contacts No. 11 and No. 10 are used in closed circuit alarm systems to protect against intrusion through windows, walls, ceilings, safes, cabinets, etc. They will initiate an alarm when a vibration of sufficient force strikes the protected surface. Vibration contacts can be adjusted to respond on any surface — glass windows, plaster board construction, and even cement walls.

• Protects possible entry/access points walls, ceilings, windows • Extra economy for multipane windows, one frame-mounted No. 11 will protect entire window • Also guards safes and cabinets against attack • Simple screwdriver adjustment for sensitivity • Slim, modern dust-sealed case; ribbed backing for firm adhesion to smooth surfaces • U L Listed

Assignment

- Complete job sheet.
- Complete self assessment and check results with answer sheet.
- Complete post assessment and have instructor score results.

INSTRUCTIONAL LEARNING SYSTEMS

Job Sheet

WIRE A SIMPLE ALARM CIRCUIT

- Materials
  - Power supply
  - Control unit
  - Reed magnet switch
- Procedure
  - Wire a Reed magnet switch into a closed circuit as shown in the package. Place switch on door.
  - Arm the circuit.
  - Test circuit by opening door.

Self Assessment

1. Draw a diagram of basic alarm system and label main parts.

2. List four power sources for operating alarm systems.

3. Define a "hard wired" system.

4. Sketch a "normally open" circuit.

5. Sketch a "normally closed" circuit.

6. Describe "armed" and "disarmed" systems.

7. Reed and magnet switches are normally used in ______________ circuits.

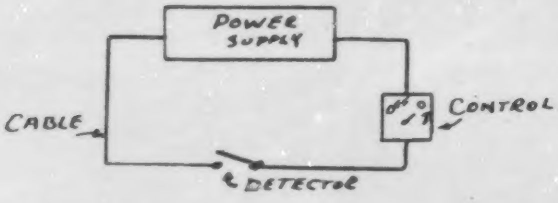
8. Breaking of window glass can be detected by using a ______________ switch.

9. ________________ switches can be used to secure a control system.

10. An intruders weight can trigger an alarm if they step on ____________
    ________________ ________________________.

Self Assessment Answers

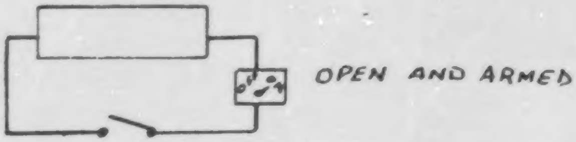
1.


POWER SUPPLY
CABLE
CONTROL
DETECTOR

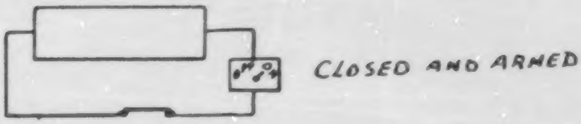
2. Radio signals
   Electricity
   Magents
   Beams of light

3. A hardwired system is one that uses wires to connect the main parts.

4.


OPEN AND ARMED

5.


CLOSED AND ARMED

6. Armed means the alarm will go off when the circuit is disturbed. Disarmed means that the system has been turned off.

7. Closed

8. Vibration

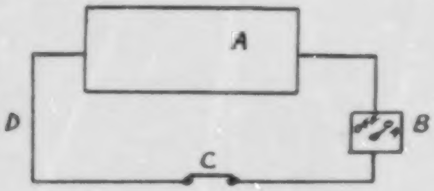
9. Tamper

10. Pressure sensitive matting.

Post Assessment

1. Explain the use of Reed and magnet switches.
2. Explain the use of vibration switches.

STUDY THIS DRAWING OF AN ALARM SYSTEM AND ANSWER QUESTIONS 3 - 10:



3. What type of circuit is shown?
4. Is the system armed?
5. What part is represented at A?
6. What part is represented at B?
7. What part is represented at C?
8. Describe the system if switch is turned to OFF in B.
9. Describe the circuit if switch is opened at C.
10. What does D tell us about this system? Describe.

Instructor Post Assessment Answers

1. Reed and magnet switches are used on doors and windows. When doors or windows open, it breaks a closed circuit and sounds alarm.

2. Vibration switches are used to detect breaking of glass. A sensor detects the shock of breaking glass and oeprates the switch.

3. Closed circuit.

4. Yes

5. Power supply.

6. Control unit.

7. Detector

8. Disarmed

9. Open circuit

10. D tells us that it is a hard-wired system.

Supplementary References

Security Alarms
and Devices. Singer
Career Systems.
Rochester, New York

INSTRUCTIONAL LEARNING SYSTEMS

10.2

BURGLAR ALARMS

Goal:

The apprentice will be able to describe types of burglar alarm systems and their applications.

Performance Indicators:

1. Describe components of a burglar alarm system.
2. Describe zones of detection in a burglar alarm system.
3. Describe types of detection devices used in each zone of detection.
4. Describe types of monitoring systems for burglar alarms.
5. List signal transmission systems.
6. Describe response force for burglar alarms.
7. Describe burglar alarm applications in commercial, industrial and residential settings.

Study Guide

- Read goal and performance indicators to find what you are expected to learn from package.
- Read the vocabulary list to find the trade terms that will be introduced in this package.
- Study introduction and information sheets to learn technical content of package.
- Complete the job sheet.
- Complete the self-assessment to test knowledge of the package contents. Check your own answers with answer sheet.
- Complete post assessment and have instructor check your answers.

Vocabulary

- AC system
- Annunciation
- Building interior zone
- Building perimeter zone
- Commercial stations
- Detection devices
- DC system
- Digital dialers
- Exterior zone of detection
- Fence disturbance sensors
- Intrusion detector
- Invisible beam detectors
- Monitoring station
- Multiplex system
- Perimeter penetration zone
- Proprietary stations
- Protected item zone
- Proximity detectors
- Response force
- Telephone dialers
- Zones of detection

Introduction

Since Biblical times, man has struggled to keep valuables safe from burglars. The Egyptians and Chinese developed locks some 5,000 years ago. The only alarm device to be developed during the Dark Ages was the church bell. The people had very little worth protecting during that age. Church bells were used to signal disasters such as fire, death and civil emergencies. When banks became a target of robbers and burglars, the time lock was invented.

The modern burglar has a much higher skill level than did their grandfathers. That skill level must be met with even greater skill by those that design burglar alarm systems. The designers of systems must be able to outwit the burglar. This means that the systems must continue to change as the burglar learns to outwit the old designs.

Information

Burglar alarm systems are designed to protect property during the absence of the property owner. The system may operate while the owner sleeps or is on vacation. It offers protection against being burglarized.

The skill levels of burglars range from low to very high. Simple security systems are adequate for detecting low skill burglars. But for the highly skilled burglar, complex systems are required. Many burglars know the technical features of burglar alarms and can disarm the systems with great ease.

A burglar enters the premises for the purpose of stealing property. They are intruders upon the property of others. So a burglar alarm system must involve intrusion detectors. Once the intrusion is detected, a signal must be communicated to a response force. The response force may be a security guard on the premises; the local police department; or a brave property owner that wants to handle their own burglars.

Burglar alarm systems have the following components:

1. Detection devices to signal the presence of a burglar.
2. Signal processor to evaluate the signal and send it to the monitoring.
3. Monitoring station to receive the signal and alert the response force.
4. Response force to apprehend the burglar.

The components of the system must be working together for a fast response to alarms. The response force must arrive quickly or the burglar will have cleared the building and be long gone. The response time is critical if the burglar is to be caught.

Some systems are designed to deter burglars from completing their mission. Such systems use annunciators at the scene to frighten away the burglar. Flashing lights, sirens, bells and other types of annunciators are used in a burglar deterrant system. This type of system is designed to scare burglars--not to catch them.

ZONES OF DETECTION

The burglar system must consider five zones of detection when designing a burglar alarm system.

Information

1. Perimeter penetration zone is the outer line of protection about the property. This may be the property line or a smaller area. It depends on the level of threat from the burglar. This line is where the burglar first becomes the personal problem of the property owner.

2. Exterior zone of detection is the area between the perimeter and the property being protected. This may be a courtyard, garden or lawn area that the burglar must cross to reach the protected property.

3. Perimeter of building is the third zone of protection. This is the building where the assets are stored.

4. Interior of building is the fourth zone of protection. This includes hallways, elevators and stairways-that a burglar must move through to reach the protected items.

5. The protected item is the fifth zone of detection. The burglar is detected when they come near or touch the protected item.

DETECTION DEVICES

Special detection devices are needed for each zone of detection. Perimeter penetration is detected by such devices as:

- Geophone transducers
- Electric field sensors
- Taut wire switches
- Piezoelectric transducers
- Electromechanical transducers
- Electret cable transducers
- Strain magnetic line sensors

All of these sensors are designed to detect fence disturbance or intrusion of the perimeter. Once the burglar has breached the perimeter, other devices are needed to detect them as they cross the exterior zone. These are likely to be:

1. Invisible beam detectors such as infrared and microwave.

2. Buried line sensors.

The building that houses the property to be protected is the third zone of detection. Special sensors are used to detect the breaking of glass and bashing of walls and doors. The devices most commonly used in protecting the building

Information

perimeter are:

1. Foil tape to detect glass breakage.
2. Grid wire on vents and other openings.
3. Vibration detector.
4. Glass breakage detectors.
5. Magnetic switches on doors and windows.

The fourth zone of detection includes areas inside the building. Motion detectors are the best choice of devices for this zone. The motion detectors include:

1. Passive infrared
2. Audio
3. Ultrasonic
4. Sonic
5. Microwave

If burglars make it through the first four detection zones without alarming the system, they are getting close to the items that they wish to steal. The devices that are very near the protected item are called proximity detectors.

Proximity detection devices usually include:

1. Pressure mats that are triggered when the burglar stands on them. These are usually placed under carpets.
2. Capacitance sensors are attached to the metal objects being protected. The burglar changes the capacitance of the electrostatic field.
3. Vibration detectors.
4. Tilt switches.

Information

MONITORING SYSTEMS

The burglar alarm system may be monitored by the property owner or a security guard. In this case, the alarm is annunciated by a horn, siren, bell or light. Upon annunciation, someone on site acts as a response force to catch the burglar. This system is only good when some person is on site at all times.

Telephone dialers convey a recorded voice message to the police department or other preprogrammed numbers. Some police departments do not allow the use of telephone dialers.

Alarm stations maintain staff to monitor the alarm systems. The stations may be commercial stations that make a profit from handling hundreds of customers. Proprietary stations are operated by agencies or individuals for the protection of their own property. The central alarm station may use one of several techniques for transmission of signals.

1. McCulloh circuit
2. DC system
3. AC system
4. Multiplex system
5. Digital dialers

RESPONSE FORCE

The response force must be considered when designing a system. Some common response forces are:

1. Security guards on site
2. Local law enforcement officers
3. Security guards on call at guard services company
4. Owners and caretakers of property.

Information

Response time is the critical factor in selecting a responce force. If the response force cannot reach the scene before the burglar passes through the detection zones, the alarm system is useless. It does not matter how many alarm signals are transmitted if the burglar has gone before the response force arrives.

APPLICATIONS

The applications for residential, commercial and industrial settings will be different. The basic zones of detection, intrusion devices and monitoring system will be more complex in an industrial or commercial setting. Commercial buildings are concerned with the protection starting at the building perimeter. Industrial sites have outside storage sites that must have protection in the perimeter penetration and exterior zones. Residential systems may need protection at the perimeter of estates or at the building perimeter. This depends on whether the residence is a small ranch or in an apartment complex.

The choice of detection devices will be based on the zones of detection. The system should become more complex as the threat is increased. Threat is dependent on the value of the items being protected and how attractive the items are to burglars. Applications in commercial, industrial and residential settings must be considered on the basis of a:

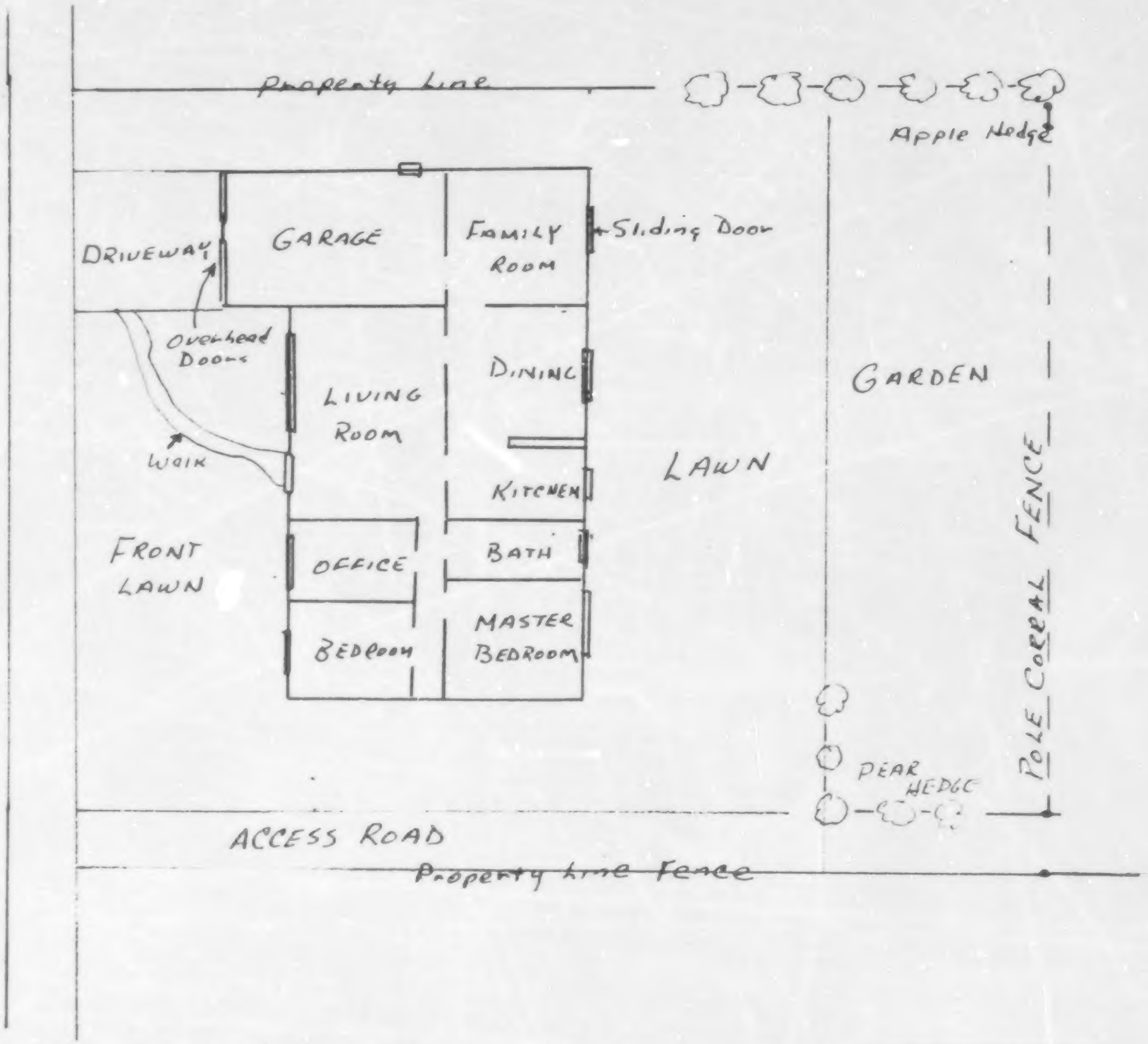
1. Threat involved.
2. Zones of detection available.
3. Monitoring system available.
4. Response force available.

Assignment

- Read Chapter 2 in the supplementary reference.
- Complete the job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Job Sheet

SKETCH A BURGLAR ALARM SYSTEM FOR A RESIDENCE


Property Line
Apple Hedge
DRIVEWAY
GARAGE
FAMILY ROOM
Sliding Door
Overhead Doors
LIVING ROOM
DINING
GARDEN
Walk
KITCHEN
LAWN
FRONT LAWN
OFFICE
BATH
MASTER BEDROOM
BEDROOM
POLE CORRAL FENCE
PEAR HEDGE
ACCESS ROAD
Property Line Fence

Job Sheet

- Mark with red pencil:
    - Perimeter detection zone
    - Exterior zone of detection
    - Building perimeter zone
- This residence is located 5 miles from town. The law enforcement is handled by the county sherriff. Both members of the family are often away from the house at the same time and for extended periods. Valuables are kept in the master bedroom.
- Show types of devices needed by zone of detection.
- Recommend a method for transmitting signals.
- Recommend a monitoring system.
- Recommend a response force.

Self Assessment

LIST DETECTION DEVICES THAT CAN BE USED IN EACH OF THE ZONES OF DETECTION:

1. Perimeter penetration zone:

2. Exterior zone:

3. Building perimeter zone:

4. Building interior zone:

5. Protected item zone (Proximity detection)

ANSWER THE FOLLOWING QUESTIONS:

6. List two types of alarm stations.

7. List three methods for transmission of signals to an alarm station.

8. List four major considerations when designing commercial, industrial and residential systems:

9. List the components of a burglar alarm system.

10. How does a burglar deterrant system work?

Self Assessment Answers

1. Geophone, piezoelectric, electret cable and electromechanical transducers. Electric field sensors. Taut wire switches.

2. Invisible beam detectors and buried line sensors.

3. Foil tape, magnetic switches, grid wire, vibration detectors, glass breakage detectors.

4. Passive infrared, audio, ultrasonic, sonic and microwave. All are motion detectors.

5. Pressure mats, capacitance sensors, vibration detectors and tilt switches.

6. Commercial and proprietary

7. McCulloh circuit, AC system, DC system, multiplex system and digital dialers.

8. Threat, detection zones, monitoring system and response force.

9. Detection devices, signal processor, monitoring station and response force.

10. Local annunciators such as sirens, bells and lights are supposed to scare a burglar away before he takes the protected item.

•Post Assessment

- Describe burglar alarm systems. Make sure that the following points are covered in written description:
  - Components of a system
  - Zones of detection
  - Detection devices
  - Monitoring systems
  - Signal transmission
  - Response force
  - Considerations in design of commercial, residential and industrial applications

Instructor Post Assessment Answers

- Review the apprentice's description of burglar alarm systems.
- Critique the apprentice's description of burglar alarm systems.
  - Are ideas about burglar alarm systems correct?
  - Are there additional points that the apprentice should know?

Supplementary References

- Barnard, Robert L. *Intrusion Detection Systems: Principles of Operation and Applications*. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

10.3

FIRE ALARMS

Goal:

The apprentice will be able to describe fire alarm systems.

Performance Indicators:

1. Describe the nature of fire.
2. Describe detection methods and devices.
3. Describe general rules for installation of fire and smoke alarms.
4. Describe a fire alarm system.

Study Guide

- Read the goal and performance indicators to find what is to be learned from package.
- Read the vocabulary list to find new words that will be used in package.
- Read the introduction and information sheets.
- Complete the job sheet.
- Complete self assessment.
- Complete post assessment.

Vocabulary

- Audible annunciation
- Fixed temperature detector
- Flame detector
- Infrared detector
- Inonization detector
- Photoelectric particle detector
- Rate of rise detector
- Single station
- Spontaneous combustion
- Thermal detector
- Ultraviolet detector

Introduction

Fire detection is aimed at the protection of both lives and property. In order to save lives, fire must be detected in its early stages.

Fire detection devices respond to smoke and flame. This differs from the burglar detection devices that respond to sound, motion, vibration and changes in electric fields.

Fire, burglar and panic alarms are often part of the same reporting and monitoring systems. The response force is usually a trained fire crew instead of a police officer. The signal transmission systems are the same for all alarm systems.

Information

Fire results when fuel, oxygen and heat are brought together. Once started, a fire will continue until one of the three ingredients is removed. Fires sometimes start as the result of accidents or explosions. More often they start quietly and unnoticed. Fires start when:

1. Heat is brought in contact with combustible material. A match or faulty electrical equipment are common examples of heat sources.
2. Combustible material generates enough heat on its own to ignite. This is called spontaneous combustion. Oily rags, wet hay and piles of trash are examples of spontaneous combustible materials.

Smoke from fires is composed of gasses that are poisionous to people. People must be separated from fires before they are overcome with smoke. Smoke can kill or cause people to react in crazy ways.

A fire alarm system must provide an early warning to the people living or working in a building. This need for early warning has been the basis for development of fire detection devices used today.

METHODS OF DETECTION

Four basic types of fire detection equipment are:

1. Heat actuated or "thermal" detectors.
2. Photoelectric particle detectors.
3. Ultraviolet and infrared flame detectors.
4. Ionization devices reacting to particles of combustion.

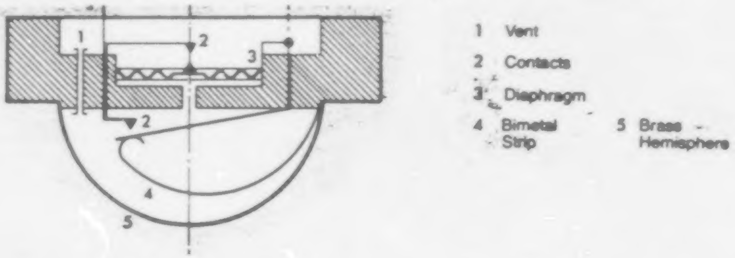
THERMAL DETECTORS

There are two basic types of thermal detectors:

1. Fixed temperature detector that alarms when the temperature goes beyond 135° F.
2. Fixed temperature and rate of rise detector.

Information

The following drawing shows the second type of detector.


1
2
3
2
4
5
1 Vent
2 Contacts
3 Diaphragm
4 Bimetal Strip
5 Brass Hemisphere

If the heat buildup exceeds 15° rise per minute, the diaphgram will move and close the contacts.

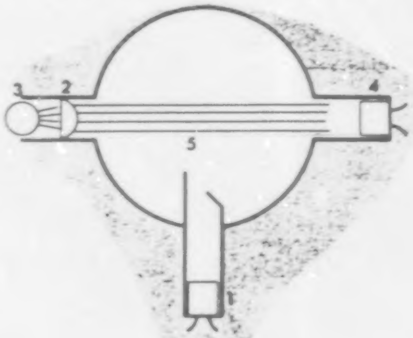
PHOTOELECTRIC DETECTORS

These units operate on the principle of the "electric eye." There are two types of photoelectric detectors:

1. One has a light bulb that directs a beam of light into a photo-sensitive cell. As smoke closes out the light. a change in conductivity will cause an alarm.

2. The second type depends on reflected light. This type is generally supplied by manufacturers of fire alarm devices. Light reflected from smoke particles will trigger the alarm.

A drawing of this type of detector is shown below.


3
2
4
5
1
1 Alarm Photocell
2 Lens
3 Light Source
4 Monitoring Photocell
5 Light Beam

Photoelectric devices offer advantages over thermal devices because they detect smoke. This gives earlier warnings of fire.

ULTRAVIOLET AND INFRARED DEVICES

These are special purpose devices. Mostly, they are used to alarm to rapidly

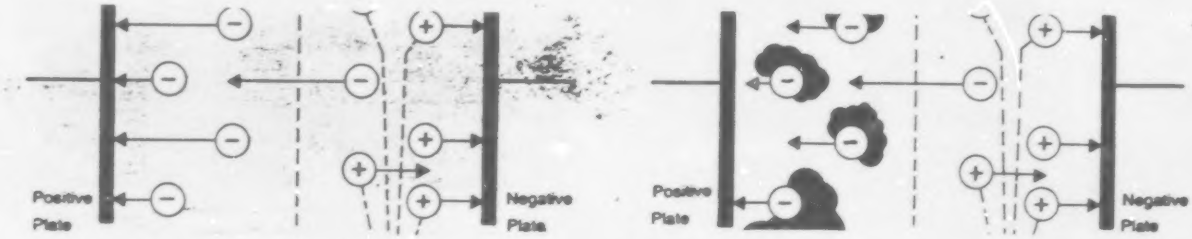
BEST COPY AVAILABLE

Information

expanding fires. These detectors are called flame detectors because they will only respond to flame. Flame detectors are used as protection in storage areas with flammable supplies. These detectors can be triggered by the flickering light of a flame.

IONIZATION DETECTORS

The ionization detector is the best device for fire protection on the market today. Radioactive material is used to ionize air molecules into plus and minus particles. When particles from combustion enter the air particles, it results in larger particles. These larger particles travel slower and causes a change in the current flow. The change in current causes an alarm signal. Ionization detectors can detect fire well in advance of actual flame. The following drawings show the electrodes in a constant state and with mass particles.



INSTALLATION OF ALARMS

Fire detection units may be installed as a single station or as a system. Many home and small retail users use the single station. The single station either has an audible alarm or is connected to a nearby local alarm. In larger structures such as schools and apartments, the buildings are divided into protection zones. Each zone is protected by detectors which are monitored by a central control unit.

RULES FOR INSTALLATION

1. Detectors shall be located on the ceiling.
2. Detectors shall not be placed in the direct path of air from air supply registers.
3. Detectors should be placed at least two feet from walls or beams.
4. Staircases can be protected by installing detectors on the ceiling of the top floor landing.

Information

5. Detectors should not be placed in dead air spaces at the top of doors.
6. Detectors may be built into automatic door closing devices.
7. Detectors should be located close to sleeping quarters in residences.
8. Detectors in the duct system must be carefully located.
9. Detectors must be located upstream of filters in return ducts and downstream in the supply ducts.
10. Makeup air intake to ventilation systems should be protected by a detector.

ANNUNCIATION

Fire alarms all have some type of audible annunciation feature. A siren, bell or whistle is required for warning the occupatants of the building. The annunciation is usually loud and shrill. It is designed to get their attention so that they can vacate the building. This differes from burglar alarm systems that often use visual annunciation so that burglars do not know that they have been detected.

FIRE ALARM SYSTEMS

A fire alarm system has the same components as a burglar alarm system:

1. Fire detectors.
2. Signal processor and transmission line.
3. Monitoring station.
4. Response force.

The systems for transmission of signals to a central station were discussed in other packages. These systems include:

1. McCulloh circuit.
2. D.C. current.
3. A.C. current.
4. Multiplexing

Information

5. Digital dialers

Monitoring systems for fire alarms are usually the same as that used for burglar alarms. Commercial and proprietary stations handle fire, burglar and panic alarm systems. The response force for fire alarms is normally a city fire department or rural fire department. Fire departments maintain crews around the clock and offer quick response to alarms.

EXTINGUISHING EQUIPMENT

Fire alarms are often linked with a water sprinkler system. When the system alarms, a waterflow switch opens gate valves and the sprinklers come on. This system also has supervisory switches to monitor the water pressure during an alarm. A separate package will be devoted to extinguishing devices.

Assignment

- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Job Sheet

VISIT A FIRE STATION

- Obtain permission to visit a fire station.
- Observe the systems for:
  - Processing alarms
  - Responding to fires
  - Transmission of signals
  - Promoting fire prevention
- Make block diagram of fire alarm system from detection to response force action.

Self Assessment

1. Describe two ways in which fires are started.

2. Why is smoke a hazard to people involved in fires?

3. List two types of thermal detectors.

4. Which detector offers the advantage of early detection--thermal or photoelectric?

5. List two flame detector devices?

6. Which detector is most widely used today?

7. Home owners usually operate ____________ station alarms.

8. Schools and large buildings zone protected areas into a ______________.

9. Where should fire detectors be located within rooms?

10. What is audible annunciation?

Self Assessment Answers

1. Heat brought in contact with combustible material and by spontaneous combustion.
2. Smoke contains toxic gasses.
3. Fixed temperature and rate of rise.
4. Photoelectric.
5. Ultraviolet and infrared.
6. Ionization
7. Single
8. System
9. Ceiling
10. Audible annunciation is sirens, bells, horns and other noise-making devices.

Post Assessment

1. Describe a fire alarm system. (In writing)
    - Types of detectors
    - Rules for installation of detectors
    - System for monitoring alarms.
    - Transmission line system.
    - Response force.

2. Draw a block diagram that shows signal flow from protected area to response force.

Instructor Post Assessment Answers

1. Have instructor review description of fire alarm system and correct any misconceptions about fire alarm systems.

2. Have instructor review block diagram and make revisions needed for correction.

Supplementary References

- Security, Distributing Marketing Magazine, P.O. Box 272, Culver City, CA 90230.

INSTRUCTIONAL LEARNING SYSTEMS

10.4

HOLD-UP ALARM SYSTEMS

Goal:

The apprentice will be able to describe hold-up alarm devices and applications.

Performance Indicators:

1. Describe the wired devices used in hold-up alarm systems.
2. Describe wireless devices used in hold-up alarm systems.
3. Describe how hold-up systems differ from fire and burglar systems.

Study Guide

- Read goal and performance indicators. Identify what is to be learned from package.
- Read the vocabulary list. Get acquainted with the new trade terms to be found in this package.
- Read the introduction and information sheets for technical content of the package.
- Complete requirements of the job sheet.
- Assess your knowledge of hold-up alarms by completing the self assessment sheet. Check your answers.
- Demonstrate your knowledge of hold-up alarm systems to your instructor. Complete the post assessment and ask the instructor to check your answers.

Vocabulary

- Buddy system units
- Dead traps
- Double press switches
- Hold-up buttons
- Hold-up foot rails
- Live traps
- Money clips
- Money sentry transmitter
- Single push switch
- Traps

Introduction

Intrusion alarm systems are designed for detection of those that sneak into protected areas. These types do not wish to be observed by others while they are involved in an intrusion.

The armed robber presents a different set of conditions. They use guns or other force to take the property of their victims. The caretakers of the protected property are on the site at the time of the hold-up. The victims of a hold-up are usually fearful of the persons committing the hold-up. They cannot telephone for help without the risk of being injured.

Hold-up systems are designed in a way that alarm switches can be secretly tripped. Some systems are designed so that the hold-up bandit will trip the alarm switch without knowing it.

Information

Hold-up alarms are usually monitored at a law enforcement station. The response force must act quickly to hold-up alarms if the bandit is to be caught. Aside from the special alarm switches, the components of a hold-up alarm system are very much like fire and burglar systems. The signal processing and transmission systems are often used in combination with fire and burglar alarm systems.

This package will identify some devices that are used in a hold-up alarm system.

WIRED SWITCHES

HOLD-UP FOOT RAILS

Foot rails are alarm devices that can be activated by the feet. A bank teller, for instance, can trip the alarm with their toe while holding their hands high in the air. A photograph of a foot rail is shown below.

NO. 266 HOLD-UP FOOT RAIL

Easy to operate • Upward movement of toe activates alarm • Rugged cast aluminum housing • 18'' wide • DPDT contacts • Indicator flag with Key reset immediately pinpoints cause of alarm • U.L. Listed • Grey wrinkle finish • Ideal for banks, jewelry and liquor stores

MONEY CLIPS

Money clips are designed to be placed in cash registers and cash boxes. Two bills are placed in the clip section of the switch. Other bills are placed on top. The alarm goes off when the two bills are removed from the clip. A money clip is shown below.

NO. 264 MONEY CLIP

Designed for installation in cash registers, cash boxes and at tellers' windows • Two bills are placed under the clip section of the switch • Additional bills in the cash drawer are placed on top of the clip. An alarm will be activated only if the two bottom bills are removed • SPDT contacts • U.L. Listed

Information

TRAPS

Traps are designed to be tripped by the intruder. A "live trap" is wired as a closed circuit switch. When the intruder trips over the trap cord, the contacts open and the alarm sounds. A "dead trap" is wired as an open circuit. If the intruder breaks the trap cord, the contacts close to trigger an alarm. A trap is shown below.

NOS. 75/76 "LIVE" OR "DEAD" TRAPS
Insulated • Use for "live" or "dead" installations • Use No. 75 for closed circuit systems and No. 76 for open circuit systems • Trap clip included

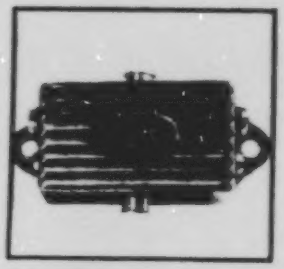
DOUBLE PRESS SWITCHES

Another type of hold-up alarm is a press switch that activates when the switch box is pressed on both sides. A photograph of a press switch is shown below.

NO. 268 DOUBLE PRESS HOLD-UP SWITCH
Eliminates accidental alarms • Will not activate alarm unless both sides are pressed • Locks in once activated • Requires Key to reset and has built-in indicator flag • SPDT • U.L. Listed

HOLD-UP BUTTONS

The hold-up button switch has two small buttons--one on each side of the box. Both buttons must be pressed at the same time to trigger an alarm.

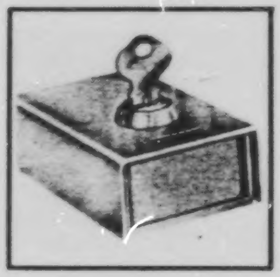


NO. 267 MINIATURE HOLD-UP BUTTON
No larger than an Ademco No. 34 magnetic contact • Buttons on either side must be depressed together to activate alarm (open the protective circuit) • SPST • U.L. Listed • Grey

Information

SINGLE PUSH HOLD-UP SWITCHES

These switches are designed for silent operation. They have a key for resetting the system. A single push switch is shown below.



NO. 269 SINGLE PUSH HOLD-UP SWITCH
Specially designed for silent operation • Attractive stainless steel housing • Indicator flag and Key reset • DPDT contacts • Use with Modularm systems for supervised hold-up protection • U L Listed • 3½" L x 2½" W x 1" H

WIRELESS DEVICES

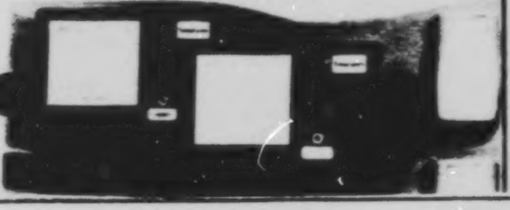
MONEY SENTRY-TRANSMITTER (WIRELESS)

This device operates very much like a money clip. When the bills are removed from the holding clip, it transmits a repeating signal to alarm stations. This wireless transmitter is usually hooked up with video cameras and other security devices. The wireless money sentry transmitter is shown below.

D-23 MONEY SENTRY TRANSMITTER
Model D-23, Money Sentry, transmitter is used in banks or wherever cash is handled. "Baited" with currency, it is hidden beneath the money stack in a cash drawer. Removing the "bait" bill from the holding clip transmits a repeating signal used to trigger alarms and other security devices such as video cameras. Completely portable, this unit is operable when cash drawers are moved.

BUDDY SYSTEM UNITS (WIRELESS)

Two or more stores can install a hold-up alarm system for the price of one conventional system. A unit consists of two receivers with built-in sonalerts and reset switches, and two transmitters.



BS-100 BUDDY SYSTEM
The BS 100 is a new concept in hold up protection. It provides inexpensive, dependable and immediate protection for two or more adjacent premises. Now two stores can be protected for less than the cost of one conventional hold up system. It is easily installed, mounts in any position on any surface and plugs into any convenient AC outlet. The BS 100 includes two BSR receivers with built in sonalerts and reset switches, two BST transmitters, two warning decals and two sets of user instructions. The CT 1 money clip is optional.

Information

HOLD-UP SYSTEMS DESIGN

DEVICES

Most devices are designed to be secretly triggered without the knowledge of the hold-up bandit. A special line of switches, money clips and traps are available for the installer of hold-up alarms.

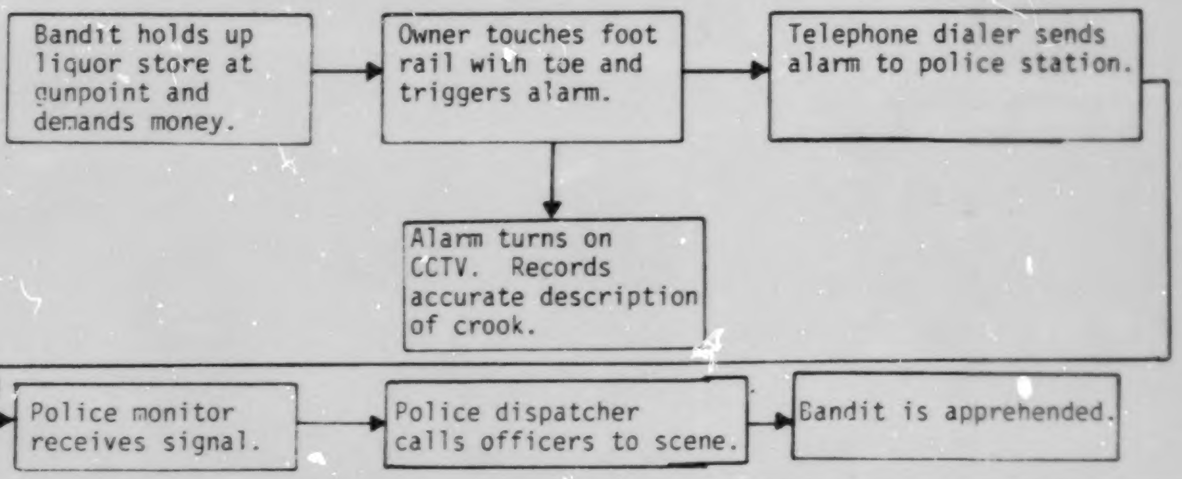
SIGNAL TRANSMISSION

Alarms are usually channeled into a central station of a law enforcement agency. Digital dialers, tape dialers and other methods can be used in hold-up alarm systems. Since it is critical that the response force move quickly, the most reliable transmission methods must be selected. Wireless systems are also used to transmit alarms. These RF transmitters operate on FCC approved frequencies.

ANNUNCIATION

Most hold-up bandits are desperate and emotional people. It could be very dangerous to the hold-up victim to have a siren go off inside the firm being robbed. The robber might panic and shoot those being robbed. The annunciation must be directed toward those that can help--this is usually a police department or other law enforcement agency.

A hold-up alarm system might appear as follows:


Bandit holds up liquor store at gunpoint and demands money.
Owner touches foot rail with toe and triggers alarm.
Telephone dialer sends alarm to police station.
Alarm turns on CCTV. Records accurate description of crook.
Police monitor receives signal.
Police dispatcher calls officers to scene.
Bandit is apprehended.

Information

APPLICATIONS

Hold-up alarm systems are used in banks, stores and other areas that handle large amounts of cash. The principle of hold-up alarms can be used in any application that involves duress. In situations where a victim is held hostage by force, there is a need for secret alarming devices and traps. Whether the protected item is money or personal safety, the victim might be able to trigger the alarm without being detected by the bandit. Hold-up systems may include closed circuit TV cameras that record descriptions of robbers. Descriptions can be very helpful to law enforcement and will help to get offenders convicted.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check answers.

Job Sheet

ANALYZE AN EXISTING HOLD-UP ALARM SYSTEM.

- Arrange through your instructor to visit a site that has an alarm system in operation. Perhaps you can assist in troubleshooting a system or just take a walk-through inspection tour.
- Observe all components of the system.
  - Devices such as foot rails, switches. Where are the devices located?
  - Other components such as closed circuit TV used in system.
  - Signal transmission methods. Is it a wired or wireless system?
  - Monitoring system--Who monitors the system?
- Draw a block diagram of the total system. Check its accuracy with your instructor or other highly experienced installers.

Self Assessment

1. Describe a hold-up foot rail.

2. Describe a money clip.

3. Describe live trap.

4. Describe dead trap.

5. Describe how a double press switch operates.

6. Describe how a hold-up button operates.

7. Describe a money sentry transmitter.

8. What is a "buddy system" unit?

9. Why are special type switches needed for hold-up alarm systems?

10. Should there be loud alarm annunciation at the hold-up site? Why or why not?

Self Assessment Answers

1. A switch device that can be triggered with the toe or foot.

2. A money clip is a detector that holds the contacts open with two bills. When the bills are removed, an alarm signal is transmitted.

3. A live trap is a device designed to be triggered by the hold-up person. It is wired on a closed circuit.

4. A dead trap is the same as a live trap except it is wired on an open circuit.

5. A double press switch signals when both sides of the switch are pressed at one time.

6. Two buttons, one on either side, must be pressed at the same time.

7. A money sentry transmitter is a wireless device that sends a signal when bills are removed from a clip.

8. A wireless unit that consists of transmitters and receivers. It can be shared by neighboring businesses.

9. Because the victims of a hold-up cannot make an open cry for help. The victims must be able to trip the alarm without notice of the bandit.

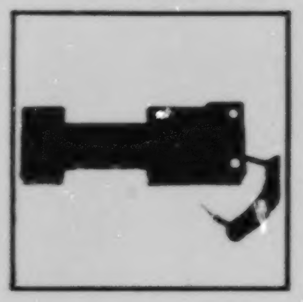
10. Loud annunciation at the hold-up site might cause the victims to be injured. Hold-up bandits are usually tense. The sound of a siren might cause them to panic and shoot the hold-up victims.

INSTRUCTIONAL LEARNING SYSTEMS

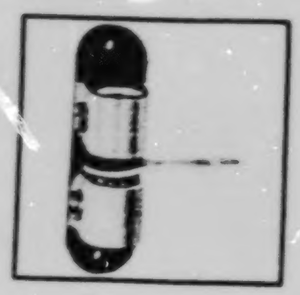
• Post Assessment

WHAT ARE THE FOLLOWING DEVICES CALLED?

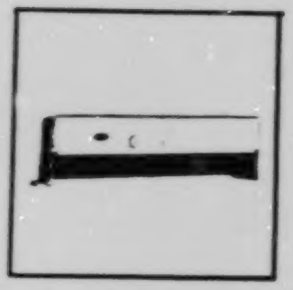
1.



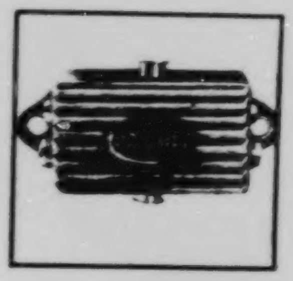
2.



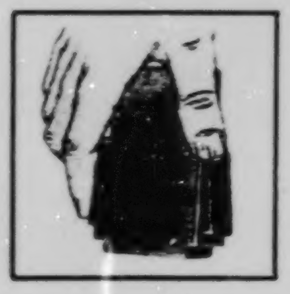
3.



4.



5.



Instructor
Post Assessment Answers

1. Money clip
2. Trap
3. Foot rail
4. Hold-up button
5. Double press switch

INSTRUCTIONAL LEARNING SYSTEMS

10.5

BANK ALARM SYSTEMS

Goal:

The apprentice will be able to describe bank alarm systems.

Performance Indicators:

1. Describe detection devices.
2. Describe annunciation.
3. Describe transmission.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Annunciation
- Bank camera
- Capacitance sensor
- Double press switch
- Glass breakage sensor
- Holdup button
- Holdup foot rail
- Magnetic switches
- Money clip
- Time lapse video recorder
- Transmission
- Trap

Introduction

Bank alarm systems are, by necessity, a confidential matter. The threat of bank robbery is ever present because of the large sums of money handled by a bank. Therefore, it is impossible to show actual design features of bank alarm system. Neither the banks or security alarm companies seem willing to share the specifics of bank alarms. Some banks were willing to discuss their alarm system in general terms.

The previous package discussed hold-up alarms. Since the hold-up alarm and a bank alarm system are quite similar, this package does not contain pictures of detection devices. The reader is referred to previous packages for pictures.

Information

Most bank alarm systems have dedicated lines direct to the local police station. For safety reasons the alarms are silent so that a trigger-happy robber is not stampeded into shooting the bank employees. Larger banks may have a central station for several branch banks. The response to bank alarms is usually a rapid one. The robber is much easier to apprehend while leaving the bank. They may be hard to catch once they are away from the robbery scene.

Detection DEvices

Bank cameras are 35mm cameras that are set to make pictures of the bank interior. These cameras make several photos per minute (2 per second is a common setting) so that all movements will be adequately covered. The photos can be utilized for identificaiton of robbers or other suspects.

Time lapse video recorders are becoming more popular in bank security. The recorder can be programmed to function when an alarm is triggered. A complete pictorial record of a holdup can be recorded and used by law enforcement officers.

Hold-up foot rails are devices that can be activated by a teller's foot. A bank robber is very nervous and might shoot a person reaching for an alarm. The foot rail is below the teller cage and can be tripped without notice.

Another type of bank alarm is the double press switch that can be alarmed by pressing on both sides of a small box. A hold-up button is similar to the double press switch except that the box has buttons on the sides.

Money clips alarm when a robber removes bills from a cash drawer. The last bill in the stack is folded under a clip. Removal of the last bill triggers an alarm.

Traps are devices placed in a way that the robber will trip them.

The bank interior may be secured during non-banking hours by motion detectors such as microwave, ultrasonic or passive infrared. The doors and window openings are secured by glass breakage sensors and magnetic switches.

The vault room itself may be protected by motion detectors, beams or sound detection equipment. Capacitance sensors are used on the vault. The choice of detection equipment will vary with the designer.

Information

Annunciation

Annunciation must be silent. Usually the annunciation occurs within a police department some distance from the bank. The alarm must be directed toward those that can help rather than toward those inside the bank. Inside annunciation is visible--not audible.

Transmission

Signals are transmitted through dedicated lines, tape dialers or digital dialers to the local law enforcement agency. In some cases, wireless systems may be used in transmitting signals. The transmission system must be selected according to the local situation of the individual bank.

Assignment

- Review earlier package on hold-up alarms.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Job Sheet

COMPARE BANK CAMERAS WITH TIME LAPSE VIDEO RECORDER

- Obtain supply catalogs.
- What advantages are claimed for bank cameras?

- What advantages are claimed for time lapse video recorders?

- What disadvantages do you see for each?

- Check your perceptions with a journeyman installer. Were you correct in your comparison?

Self Assessment

1. Why are bank alarms not annunciated audibly?

2. What is a money clip?

3. How is a hold-up rail operated?

4. What is the usual size of a bank camera?

5. How is a trap alarm triggered?

Self Assessment Answers

1. To avoid panic in the robbers that may cause them to harm innocent persons.

2. A stack of bills with the bottom one tucked under sensor. When the bill is removed, an alarm is made.

3. By the teller's foot.

4. 35 mm

5. By the robber.

Post Assessment

Match the following terms and descriptive phrases.

_____ 1. Bank camera

_____ 2. Time lapse video recorder

_____ 3. Trap

_____ 4. Hold-up rail

_____ 5. Money clip

A. Activated when bill is removed from a clip.

B. Triggered by the robber.

C. Programmed to function when an alarm triggers.

D. Makes 35 mm pictures at rate of 2 per second.

E. Triggered by foot.

Instructor Post Assessment Answers

D 1.

C 2.

B 3.

E 4.

A 5.

Supplementary References

- References on bank alarm systems are extremely scarce. Availability of such references would enable bank robbers to comprimise the security system.

INSTRUCTIONAL LEARNING SYSTEMS

10.6

WIRELESS ALARM SYSTEMS

Goal:

The apprentice will be able to describe wireless alarm systems and their applications.

Performance Indicators:

1. Describe principle of wireless alarm systems.
2. Describe components of an RF transmission system.
3. Describe applications of wireless systems.

Study Guide

- Read the goal and performance indicators to find what you are expected to learn from this package.
- Read the vocabulary list to find trade terms that will be used in this package.
- Study the introduction and information sheets to learn the technical content of this package.
- Complete the job sheet.
- Complete self assessment and check your answers.
- Complete post assessment and have the instructor check your answers.

Vocabulary

- Coaxial cable
- Coaxial connectors
- Crystal controlled oscillator
- Dual frequency channels
- Electromagnetic interference
- Line of sight systems
- Narrow band filters
- One-way RF systems
- Receiver antenna
- RF power meter
- Two-way RF system
- Transmitter antenna
- VSWR meter

Introduction

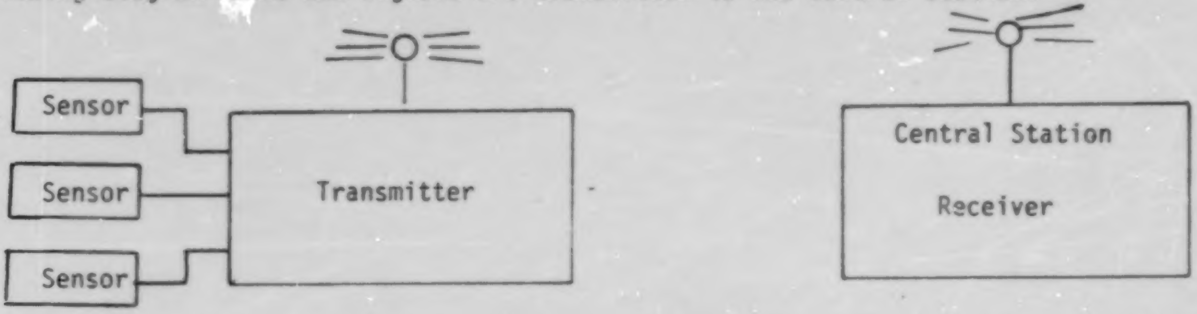
To this point the packages have dealt with wired systems. The transmission of signals required wires or telephone lines to carry the signal from the protected area to the monitoring station.

Wireless systems are also used in signal transmission. Radio frequencies can transmit signals from remote locations to a central station. The wireless systems have many applications that cannot be easily met with wired systems.

Information

Wireless alarm systems use a radio frequency to transmit alarms from the detectors to the central station. There are five dual frequency channels available for central station use. Those channels fall between 460.9 and 466.0 MHz.

RF systems are line of sight systems. The transmitter antenna must be in a line of sight with the receiver antenna. The sensors send a signal to the transmitter. The transmitter sends the signal to the receiver in the central station. The following diagram shows how signals are transmitted to the central station.



Wireless systems can be used for fire, burglar, panic and hold-up alarm systems. The greatest use of wireless systems is to monitor remote areas. It also offers the advantage of being portable. Panic transmitters or receivers allow messages to be delivered while a person is away from the site..

Electromagnetic interference is one of the biggest problems in RF alarm systems. The messages are not always clear. One technique for control of interference is to repeat the message over and over. Another control method is to use dual frequency channels.

Frequency stability is maintained by using crystal-controlled oscillators. This allows the receiver to use narrow band filters. The filters remove all signals except those within their bandpass. Filtering helps control interference.

The RF signal is transmitted from the transmitter antenna to the receiver antenna. Antennas are an important part of RF units. The antennas must be carefully located and maintained.

WIRELESS DEVICES

Wireless systems use many of the same devices as wired systems. Only the method of signal transmission is different. Some typical devices are shown on the next page.

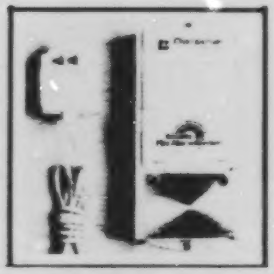
Information

PICTURES OF WIRELESS DEVICES

DS-1010 SELF-CONTAINED SIREN
12 VDC. Completely self-contained, no additional amplifier needed. Weatherproof plastic horn with rustproof metal hinge bracket. All solid state; low current:

SMOKE DETECTOR
Includes built-in transmitter. Ionization type, 9VDC operation, U.L. Listed.

PANIC TRANSMITTER
Hand held or clip for belt. Self coding, high impact plastic case.



REMOTE ALARM RECEIVER
For extra alarm location, as companion to Model DS-1031 Smoke Detector. Reset switch,

T-1 (135°)/FT-3 (190°) HEAT DETECTOR TRANSMITTERS
Transmits signal upon sensing specified temperature.

UT-4 GLASS PROTECTOR TRANSMITTER
Designed especially for use with fast-acting glass break and vibration contacts. Can be used with either NO or NC circuit. Will activate control receiver up to 200 feet away.

Information

APPLICATIONS

RF systems have many applications. Their greatest use is in monitoring remote locations, boats, pump stations and other industrial controls.

The transmitter is connected to its antenna with coaxial connectors. The receiver is also connected with its antenna by coaxial cable. The transmission cable must be kept in good repair.

The range of RF transmission is approximately 30 miles. A short range type of radio transmission is used on local sites. This type of transmission is limited to 300 feet.

The installer will find an RF power meter and a VSWR meter to be helpful in testing an RF system. These meters will test RF output of the transmitter and the antenna.

Radio signals can be blocked by buildings, mountains and other tall objects. Sometimes the signals can be bounced off of the same objects to an advantage. Antenna height will improve radio transmission. The extra height may become very expensive if it requires guy wires and additional mast.

RF transmission is available in both one and two-way systems. The new two-way systems are similar to the interrogator-response technique of multiplex systems. The receiver asks for a status report and the transmitter will respond.

Assignment

- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

INSPECT AN RF SIGNAL TRANSMISSION SYSTEM.

- Closely inspect an RF transmitter.
- Inspect a coaxial cable and coaxial connectors.
- Inspect a receiver, coaxial cable and antenna.
- Determine:
  - How sensors are attached to transmitter.
  - How coaxial cable is joined to transmitter and antenna.
  - How receiver unit is attached to its antenna.
  - How units can be adjusted.
  - How the units are supplied with power.
  - How much power is needed to operate a unit.

Self Assessment

1. How many RF channels are available to alarm installers?

2. What is meant by a line-of-sight system?

3. What is the range of RF transmission or the approved channels?

4. ______________________ are used to maintain frequency stability.

5. _______________ band filters are used to filter unwanted signals from RF receivers.

Self Assessment Answers

1. Five

2. Antennas must be in-sight of each other.

3. 30 miles

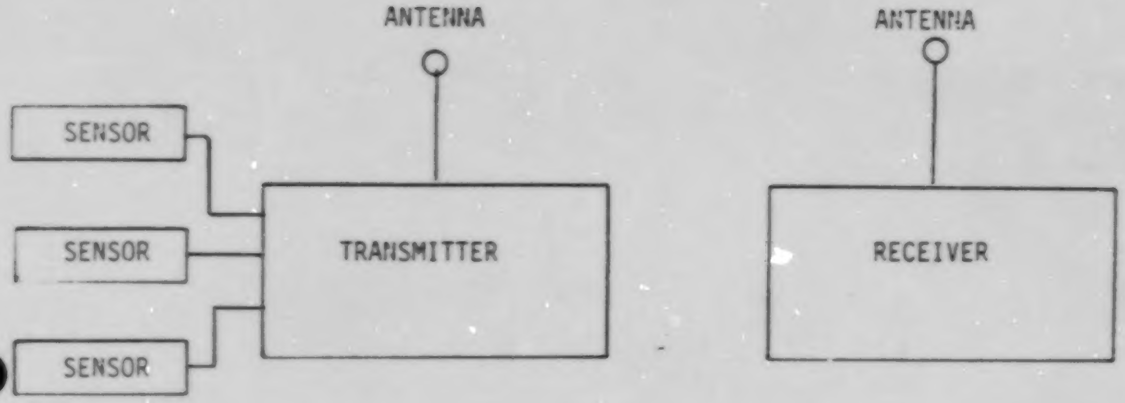
4. Crystal controlled oscillators

5. Narrow

Post Assessment

* Draw a diagram of an RF alarm system. Show relationship of sensors, transmitters, receiver and antennas.

Instructor Post Assessment Answers


ANTENNA
ANTENNA
SENSOR
SENSOR
SENSOR
TRANSMITTER
RECEIVER

INSTRUCTIONAL LEARNING SYSTEMS

11.1

HAND AND POWER TOOLS

Goal:

The apprentice will be able to identify common hand and power tools.

Performance Indicators:

1. Identify common hand and power tools by name.
2. Describe the use of hand and power tools.

Study Guide

- Read the goals and performance indicators to find what is to be learned from package.
- Study the pictures of tools and the uses of each one. You may have used many of these tools in the past. If so, check to see that you have been using them for the purpose intended.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete post assessment and ask the instructor to score answers.

Vocabulary

- Learn the names of all tools shown in information sheets.

Introduction

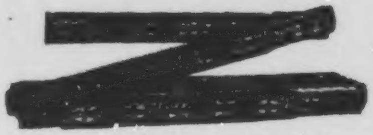
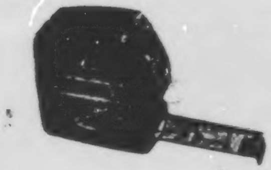
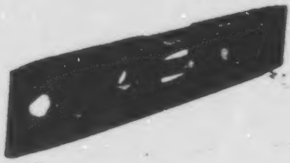
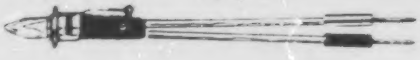
Low voltage installers must know the theory of the alarm systems that are being installed. Beyond the theory, the installer must be skilled in the use of hand and power tools. Without such skill with tools, the installation will be slow and expensive.

Skill with tools is basic to good workmanship. An alarm system requires good workmanship to alarm properly. The apprentice should know the names of common tools and what those tools can be used for.

When learning the use of a new tool, read the instructions or ask an experienced person to demonstrate its use. It is easier to start properly than to break old habits.

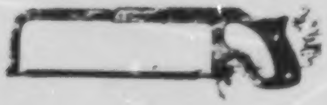
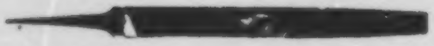
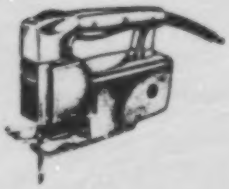
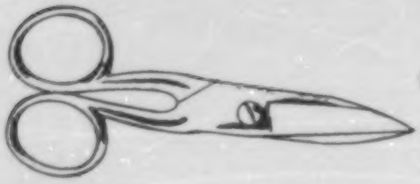
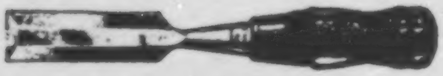
Information

MEASURING AND TESTING TOOLS

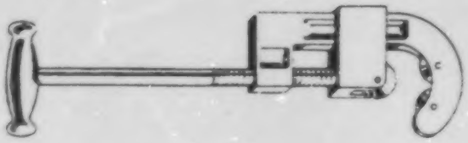
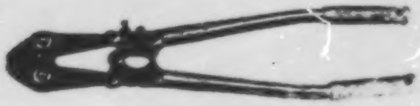
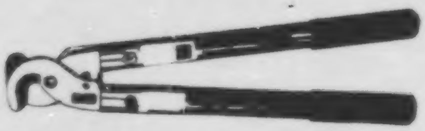
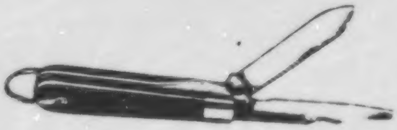
Folding rule		Measure distance on walls, cable, conduit, etc.
Tape measure		Measure distance on walls, cable, conduit, etc.
Torpedo level		Level conduit and equipment.
Circuit tester		Check for power and identify conductors.

Information

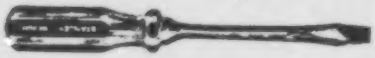
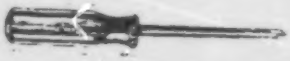
CUTTING TOOLS

Hacksaw		Cut conduit, cable and metal.
Keyhole saw		Cut holes through plasterboard.
File		Sharpen tools
Sabre saw		Cuts holes through plasterboard.
Electrician's scissors		Cut small conductors.
Chisel		Notch wood for cable or boxes.

Information

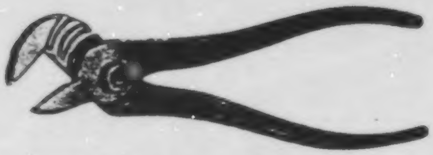
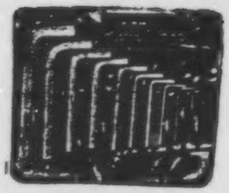
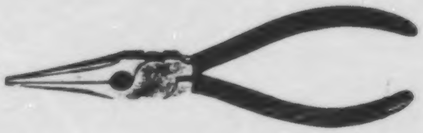
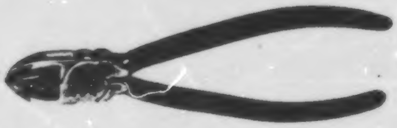
Pipe cutter		Cut large bolts.
Bolt cutter		Cut large bolts, locks, etc.
Cable cutter		Cuts large cable.
Electrician's knife		Strip insulation from conductors.

SCREWDRIVERS

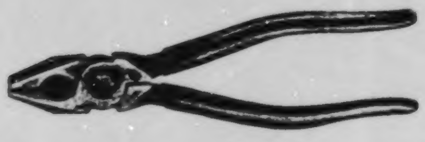
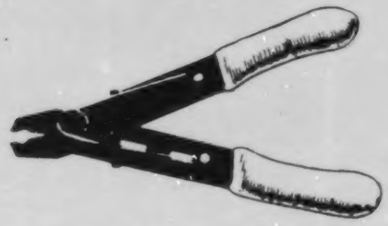
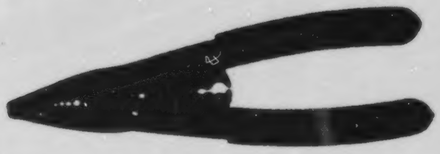
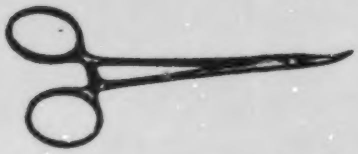
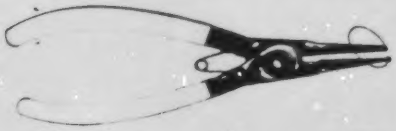
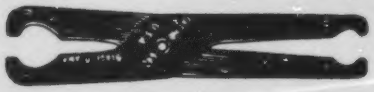
Flat blade screwdriver		Tighten or loosen slot-head screws/
Phillips screwdriver		Tighten or loosen Phillips head screws.

Information

WRENCHES AND PLIERS

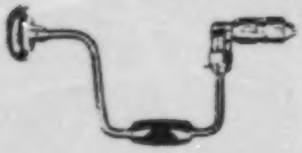
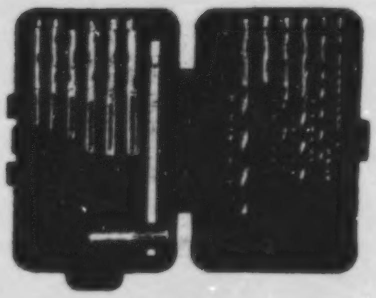
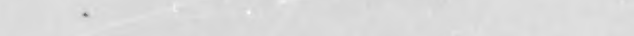
Adjustable wrench		General purpose wrench.
Pump pliers		Tighten couplings and conductors in conduit.
Allen wrenches		Installs or removes Allen screws.
Needle nose pliers		Form small loops on conductors.
Diagonal pliers		Cut conductors where space is limited.

Information

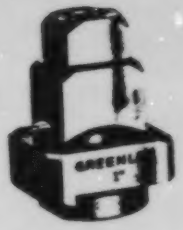
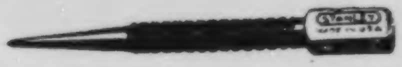
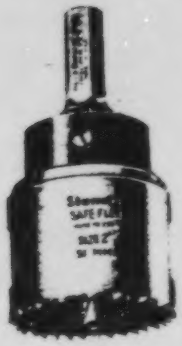
Linemans pliers		Cuts and holds large conductors.
Adjustable wire stripper		Strips insulation from conductors.
Cutting/ crimping tool		Strips and cuts conductors, crimps wire lugs.
Hemostat		Used to keep heat away from components by clipping them out of the way.
Snap ring pliers		Install and remove snap rings on equipment.
Fuse puller		Removes fuses without danger of shock.

Information

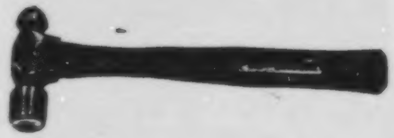
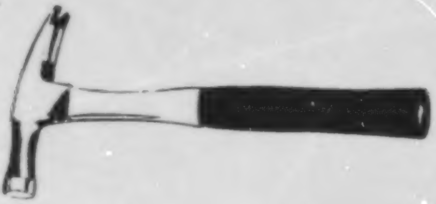
DRILLING AND BORING TOOLS

Portable drill		Drill holes for installation electronic cabinets, control units, etc.
Drill brace		Bore holes in wood for conduit.
Tap tool		Makes inside threads on drill holes.
Ship auger drill bit		Drills deep holes that require extra reach.

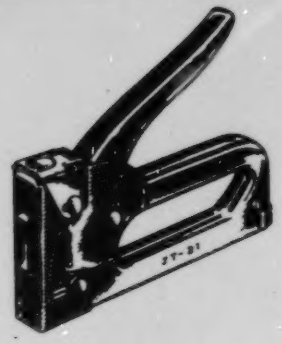
Information

Chassis punch		Punches large holes in metal boxes, etc.
Center punch		Make center punch for drilling.
Hole saw		Cuts large holes in metal.

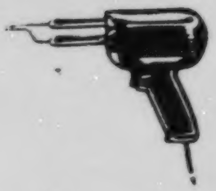
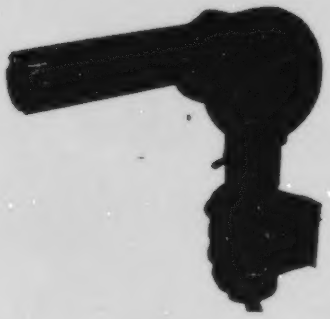
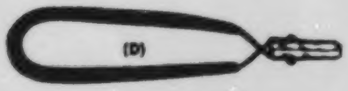
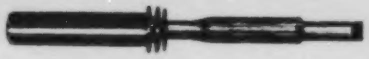
HAMMERS AND FASTENING TOOLS

Ball peen hammer		Hammer and shape metal.
Electrician's hammer		Driving and pulling nails, breaking plasterboard.

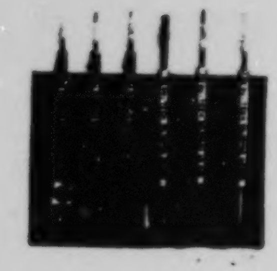
Information

Stapler		Fasten small conductors to wall.

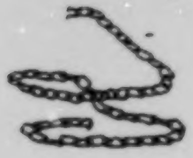
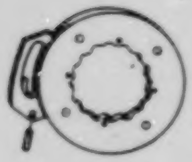
SOLDERING AND HEATING TOOLS

Soldering gun		Solder large conductors.
Heat gun		Dries conductors.
Heat sink		Keeps heat away from components when soldering.
Soldering iron		Solders small components and printed circuit boards.

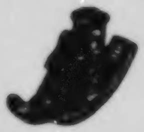
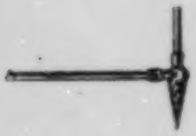
Information

Soldering aid		Cleans and holds conductors while soldering.

INSTALLATION TOOLS

Drop chain		Pulls cables through walls.
Fish tape and reel		Pulls conductors and cable through conduit and walls.

BENDING AND FORMING TOOLS

Conduit bender		Bends conduit
Pipe reamer		Removes burrs from conduit.

Assignment

- Complete the job sheet.
- Complete self assessment.
- Complete post assessment.

Job Sheet

USE A CUTTING AND CRIMPING TOOL

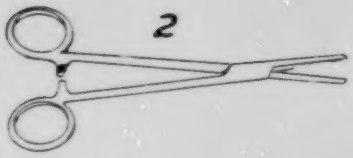
- Tools and supplies needed
  - Cutting and crimping tool
  - Insulated conductor 12-18 gauge
  - Bolt 6/32 to 10/32
  - Wire lug that fits conductor size
- Procedures
  - Locate stripping slot for the size of conductor at hand.
  - Practice cutting and removing insulation from conductor.
  - Locate crimping area on tool.
  - Insert wire lug on conductor and practice crimping.
  - Locate bolt curring area on tool.
  - Practice cutting bolt with cutting and crimping tool.
- Have instructor check work to make sure that the tool is being used properly.

Self Assessment

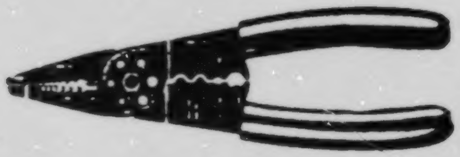
Label the following tools by their industry names:

1

2



3



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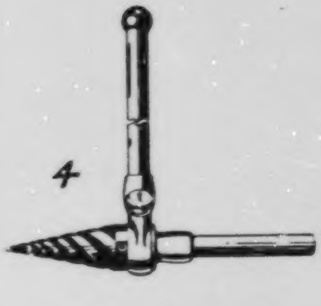

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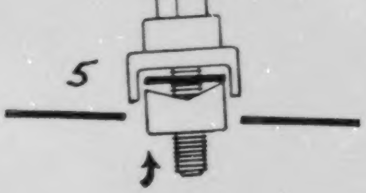

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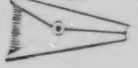
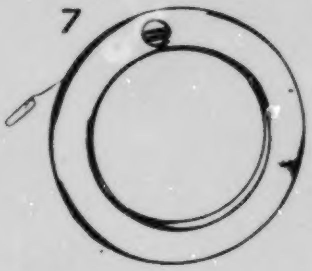
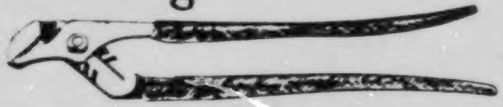


7



8



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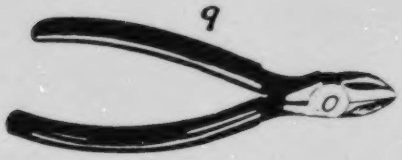
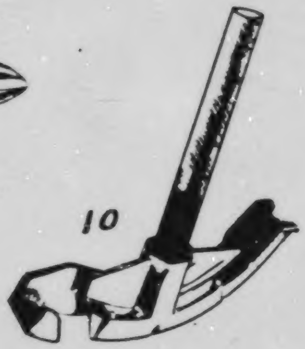


10



Self Assessment Answers

1. Circuit tester
2. Hemostat
3. Cutting/crimping tool
4. Pipe reamer
5. Chassi punch
6. Heat sink
7. Fish tape and reel
8. Pump pliers
9. Diagonal pliers
10. Conduit bender

Post Assessment

WHICH TOOL WOULD BE SELECTED FOR EACH OF THE FOLLOWING JOBS?

1. Check a circuit to see if it has power.

2. Bend a length of conduit to make a 45° angle.

3. Drill a hole that is deeper than regular drill bits can reach.

4. Punch a large hole in metal control box.

5. Keep heat away from electrical components during soldering.

6. Pull conductors through a conduit raceway.

7. Cut conductors inside a cramped space.

8. Remove snap rings on equipment.

9. Remove a fuse without risk of shock.

10. Make inside threads on a drill hole.

Instructor Post Assessment Answers

1. Circuit tester
2. Conduit bender
3. Ship auger drill bit
4. Chassis punch
5. Heat sink
6. Fish tape and reel
7. Diagonal pliers
8. Snap ring plier
9. Fuse puller
10. Tap tool

INSTRUCTIONAL LEARNING SYSTEMS

11.2

MAINTAIN HAND AND POWER TOOLS

Goal:

The apprentice will be able to maintain hand and power tools.

Performance Indicators:

1. Use tools for the purpose intended.
2. Keep tools free of rust.
3. Repair or replace broken and damaged tools.

Introduction

Maintenance of tools is an important part of a craftsman's job. If tools are not maintained, the installer will spend too much time at "fighting" tools. The tool must be maintained before it is needed. It is a costly procedure to stop an installation to repair a hand tool. Tools should be maintained when they are put away from a job.

Good maintenance is more a matter of attitude and habit than it is of know-how. Some people feel that maintenance takes time away from production. These people prefer to fight dull and broken tools rather than to take time out for maintenance. Others have developed sloppy habits in caring for tools. Such habits are difficult to break.

Tool maintenance must be made a part of all training programs. The efficient installer has all of the tools needed for a job; tools that work when needed; and knows how to use tools for their intended purpose.

Information

RULE 1

USE TOOLS FOR THEIR INTENDED PURPOSE

Tools are usually damaged when they are used for purposes that are beyond that for which they were designed. For example, diagonal pliers are used to cut small conductors. If diagonal pliers are used on a very heavy conductor, the jaws are likely to be sprung. Lineman pliers should have been selected for the job. Screwdrivers should not be used in cases where the blades do not match the size of the screw slot. Each tool is designed for specific uses. The first step in a maintenance program is to use the tool for those recommended purposes.

RULE 2

KEEP TOOLS FREE OF RUST

Rusty tools make problems for the user. Adjustable wrenches will not adjust when rusted. Pliers are difficult to use when the jaws are rusted. Rust can be avoided by keeping tools clean and dry. A few drops of oil will prevent rust from forming in the first place.

RULE 3

KEEP CUTTING TOOLS SHARP

Dull saws and drills tend to slow down an installation job. Cutting tools should have their cutting edges protected when not in use. When thrown about, their cutting edges are easily dulled. Cutting tools should be sharpened before they become dull.

RULE 4

REPAIR OR REPLACE DAMAGED TOOLS

Screwdrivers with damaged blades should be ground into working shape or discarded completely. Damaged tools should never be left in the tool kit. They should be set aside for repair or replacement. Electric power tools should be inspected for damaged cords and repaired as needed.

Information

RULE 5

ORGANIZE TOOL KIT

Tools should be organized in a way that they are easy to find. A tool kit should be organized so that one tool does not damage other tools. For example, cutting edges should be protected from banging by hammers and pliers. An organized tool kit will do a lot for the maintenance of tools.

Assignment

- Complete the job sheet.
- Based on the inspection of hand tools and power tools (job sheet), complete the self assessment.
- Complete post assessment.

Job Sheet

INSPECT HAND AND POWER TOOLS

- Carefully inspect all tools for which you are currently responsible.
- Set aside tools that need:
  - Sharpening
  - Adjusting
  - Lubricating
  - Repairing
  - Replacing
- Ask instructor to confirm the maintenance needs of the set aside tools.
- Sharpen, adjust, lubricate and repair those tools that need it.
- Replace tools that are not functional.

Self Assessment

BASED ON INSPECTION IN JOB SHEET:

1. Which tools seem to be affected by rust?

2. Did you find evidence of tools having been used for jobs other than their intended purpose?

3. Which tools needed to be sharpened?

4. Which tools needed repair work?

5. Have the tools been properly lubricated in the past?

6. Did you find tools that will not work?

7. Were all the cutting edge tools sharp?

8. Was the tool kit organized in a way that tools do not damage other tools while in the kit?

9. Of the following rules, which one was most ignored with the tools in the past? Your observations should provide the answer.

    - Use tools for their intended purpose.
    - Keep tools free of rust.
    - Keep cutting tools sharp.
    - Repair or replace damaged tools.
    - Organize the tool kit.

10. What improvements in tool maintenance will you make in the future?

Self Assessment Answers

- There are no right or wrong answers to these questions.
- The perceptions and observations from the inspection and the self assessment should help you to do a better job of maintenance.

Post Assessment

BASED ON THE INSPECTION (JOB SHEET), THE RULES FOR MAINTENANCE (INFORMATION SHEET) AND THE FINDINGS OF SELF ASSESSMENT:

- List twenty (20) specific hints for maintaining hand and power tools.
- Ask the instructor to review the list and make other suggestions.

Instructor Post Assessment Answers

- There are no right or wrong answers.
- The instructor should review the twenty hints for maintaining tools and make other suggestions to the apprentice.

INSTRUCTIONAL LEARNING SYSTEMS

11.3

SAFETY PRACTICES

Goal:

The apprentice will describe approved safety practices and demonstrate safety practices on the job.

Performance Indicators:

1. Describe the Federal Safety Color Codes.
2. Describe the general rules of safety.
3. Describe special rules for electrical safety.
4. Describe a procedure for responding to accidents.

Study Guide

- Read the goal and performance indicators.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete post assessment and ask instructor to check answers.

Vocabulary

- Accidents
- Decibel range
- Federal Safety Color Code
- Safety practice

Introduction

A safe working attitude is developed over a long period of time. Safety rules are not totally effective in solving the problems of industrial accidents. The two major causes of accidents are carelessness and misuse of equipment. Carelessness is the result of an attitude of non-caring. Misuse of equipment is often the result of poor attitudes toward employers and the job.

If we are to prevent accidents, a basic attitude of caring for the safety of self and others must be developed. The accidents must be prevented by removing the hazards before accidents occur. A safe-working attitude will help the employee to foresee accidents and correct the problems. The safety practices will be followed when a safety attitude becomes part of the personal makeup of the individual.

Information

FEDERAL SAFETY COLOR CODES

The federal government has established color codes for improving safety in the workplace. Each color has a special meaning.

Yellow -- Caution, hazardous waste containers

Red -- Fire equipment, flammable liquids, emergency stops on equipment

Orange -- Dangerous parts of machines, potential shock hazards

Purple -- Radiation hazards

Green -- Safety, first aid equipment

Black -- Housekeeping purposes such as identification of maintenance shop

White -- Also used for housekeeping purposes by itself or in combination with black.

When the color codes are used to identify hazards in the workplace, people become more safety minded.

GENERAL SAFETY RULES

- Wear safety goggles in any environment where flying particles may enter the eye.
- Wear a face mask in any environment where dust, fumes or other harmful substances may enter the lungs.
- Wear ear protectors in any environment where the decibel range of the noise is high enough to damage hearing.
- Wear clothing, jewelry and hair as appropriate to the work environment. Loose clothing, long hair and jewelry are hazardous around equipment.
- Keep tools clean and sharp and use power tools for a job.

Information

- Keep work area clean of debris.
- Operate power machinery according to prescribed safety practices.
- Practice safety in the use of ladders. Set ladder at safe angle. Use ladder with non-skid feet. Do not stand on top of ladder.

ELECTRICAL SAFETY RULES

- Do not work on equipment while it is wet.
- Remove all jewelry before working on equipment.
- Check for presence of high voltage. Never assume that voltage is low.
- Turn off power before working on equipment.
- Do not take fuses and circuit breakers for granted.
- Ground all power tools.
- Beware of frayed electrical cords.
- Stand on dry surface while using electrical tools.

RESPONSE TO ACCIDENTS

- Locate circuit breaker and turn off power before touching the victim.
- Separate victim from the conductor.
- Call the paramedics or other professional help.
- Administer first aid if you have the training to perform first aid. If you do not have the training, seek the help of someone that does.

Assignment

- * Call State Accident Insurance Fund (SAIF) representative in your region. Ask for safety materials and guidelines for improving safety in industry. SAIF has many safety films that are available.
- * Complete job sheet.
- * Complete self assessment.
- * Complete post assessment.

Job Sheet

CONDUCT A SAFETY INSPECTION OF YOUR WORK ENVIRONMENT

- Inspect the work areas
  - Color coded safety zones
  - Clean work area without debris and clutter
  - Noise level below harmful frequency
  - Eye protection equipment available
  - Equipment properly guarded and grounded
  - Electric tools with good cords and grounds
  - Ladders are in good repair
- Identify safety hazards
  - Specific safety needs
  - Type of risk involved with each hazard
- Make recommendations for eliminating safety hazards
- Share recommendations with instructor or work site supervisor

Self Assessment

According to the Federal Safety Color Code what colors would the following objects be painted?

1. Gasoline can.
2. First aid cabinet.
3. Hazardous waste containers.
4. Radiation hazard area.
5. An area that has electrical shock hazards.

Other questions on safety:

6. What should be the first response to help a victim of electrical shock?
7. Why should power tools be grounded?
8. Why are frayed electrical cords a hazard?
9. Why is loose clothing a hazard?
10. What are the two major causes of accidents?

Self Assessment Answers

1. Red

2. Green

3. Yellow

4. Purple

5. Orange

6. Turn off power at circuit breaker

7. To avoid becoming part of the circuit.

8. Electricity will short circuit through victim.

9. Loose clothing is apt to catch in rotating equipment.

10. Carelessness and improper use of equipment.

Post Assessment

- Based on the safety inspection (job sheet) and information sheet, develop your own list of safety practices. Write at least twenty (20) safety practices that will prevent accidents at your worksite.

Instructor Post Assessment Answers

- There are no right and wrong answers. You should have a list of 20 approved safety practices.
- Review your list of safety practices with the instructor. Ask instructor to comment on the list. Add other safety practices that are recommended by instructor.

Supplementary References

* State Accident Insurance Fund (SAIF) representative.

INSTRUCTIONAL LEARNING SYSTEMS

12.1

PHOTOELECTRIC SPACE DETECTORS

Goal:

The apprentice will be able to describe photoelectric space detection devices and their applications.

Performance Indicators:

1. Describe photoelectric principle.
2. Describe difference in active and passive infrared detectors.
3. Describe LED's as a photoelectric light source.
4. Describe incandescent light as a photoelectric light source.
5. Describe problems in use of mirrors to reflect light beams.
6. Describe applications of photoelectric detectors.

Study Guide

- Study the goal and performance indicators to find what is to be learned from package.
- Read vocabulary to be introduced in package.
- Read the introduction and information sheets.
- Complete the reading assignment. (Optional)
- Complete the job sheet.
- Complete the self-assessment and check answers with answer sheet.
- Complete post assessment and ask instructor to check answers.

Vocabulary

- Active infrared detectors
- Forward bias
- Gallium diode
- Incandescent light
- Light emitting diodes (LED)
- Passive infrared detectors
- Solid state device

Introduction

Photoelectric systems are used as active barrier detectors. They are used mostly for inside barriers such as entrances and routes leading into protected areas.

All photoelectric systems work on the principle of light beams. When an intruder breaks the beam, an alarm is set off.

There are many applications for photoelectric systems in everyday life. The automatic doors at the grocery store are triggered by beams of light. Industry uses beams of light to control automated equipment.

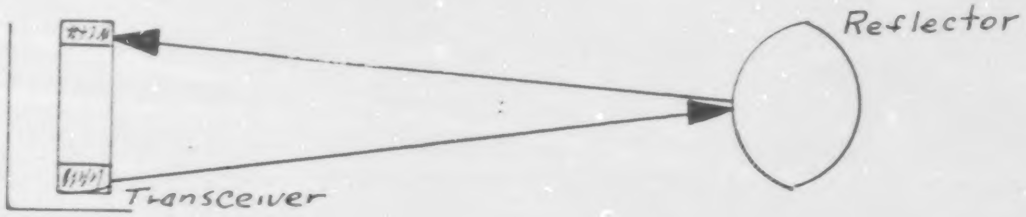
The light source is the major difference between photoelectric systems. Active infrared and LED's are the major light sources for photoelectric systems.

Information

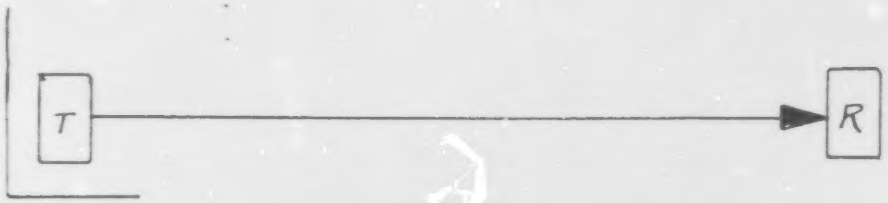
Photoelectric detectors are the oldest of space protection devices. These detectors operate on invisible beams of light. Active infrared detectors form a beam of light between a transmitter and a receiver. When intruders break this beam of light, the alarm is triggered. Other light beam sources include light emitting diodes (LED) and incandescent lights. Photoelectric systems are installed with the transmitter in one location and the receiver in another location. In special cases, both may be located in a single transceiver. Photoelectric beams may be used in both indoor and outdoor space protection.

ACTIVE INFRARED DETECTORS

Pulsed infrared is used to provide the light beam. In this application, it is called active infrared. Passive infrared operates on the basis of thermal change. Active infrared is used as a beam between transmitter and receiver. If both transmitter and receiver are housed in a transceiver unit, a reflector unit is needed. See sketch below.

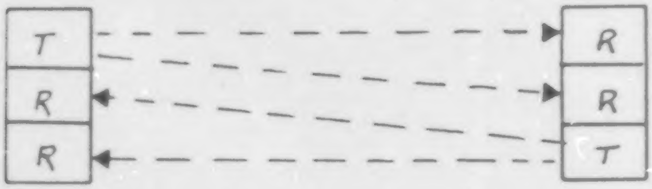


Infrared is more often used with the transmitter in one location and the receiver in another location.



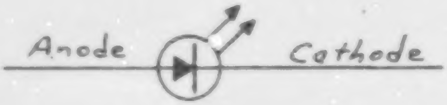
Information

The units may be "stacked" to give additional protection.

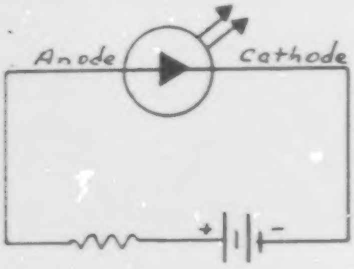


LIGHT EMITTING DIODES

A gallium arsenide light diode (LED) is often used in photoelectric systems. This LED gives a light beam of infrared orange. The beam is hardly visible to the naked eye. The beam becomes visible in fog and smoke. The gallium diode is a solid state device. Diodes have a ten-year life and are resistant to shock and vibration.
An LED will be shown in a schematic as:



It will only produce light when in forward bias:



Information

Voltages of LED's range from 1.7V to 3.3V. When properly biased, LED's will last for 100,000 hours.

INCANDESCENT LIGHT

Early systems used incandescent light as a light source. The light was filtered to make it less visible. This light source produces a red beam of light that makes it easy to see. The incandescent light is not a good beam for intrusion alarms because it can be seen by intruders. There are many industrial applications for the incandescent light beam.

APPLICATIONS OF PHOTOELECTRIC DETECTORS

Detector beams are available with ranges up to 1,000 feet. By using mirrors, the beams can be reflected around corners of buildings. Mirrors extend the coverage of photoelectric detection. At the same time, it reduces the range of the beam. Mirrors are not recommended for long range detection. Care must be shown to the installation of mirrors. Loose, misaligned mirrors will cause false alarms. Photoelectric systems are best suited to short range applications.

The photoelectric detector is best used to protect entrances. It is also useful for creating barriers to protect open and enclosed areas. The uses of photoelectric detectors extend far beyond intrusion betection. They are widely used as door openers, safety barriers and assembly line operations.

SPECIFICATIONS OF DETECTORS

Photoelectric systems can be bought to fit many designs. A selection chart from a supply catalog shows the specifications of several models. (Following page)

Information

PHOTOELECTRIC SYSTEMS
SELECTION CHART

CATALOG NO.	SURFACE OR RECESS MOUNTING	RANGE IN FEET	TYPE OF LIGHT SOURCE	TYPE OF STANDBY POWER	HOURS OF STANDBY	
No. 1325 U.L.	S	350	L.E.D. (Pulse-Modulated)	NI-CAD	12	Attractive housing hides direction of beam.
No. 1327 U.L.	S	800	L.E.D. (Pulse-Modulated)	NI-CAD	12	Attractive housing hides direction of beam.
No. 1310* U.L.	S	200	Incandescent	NI-CAD	10	
No. 1314*	S	200	Incandescent	Transmitter: NI-CAD Receiver: Dry Cell	10	
No. 1309* U.L.	S	400	L.E.D. (Pulse-Modulated)	NI-CAD	24	Not affected by normal ambient light.
No. 1318* U.L.	S	1000	L.E.D. (Pulse-Modulated)	NI-CAD	24	Not affected by normal ambient light.
No. 1355	R	3' Min. 75' Max.	L.E.D. (Pulse-Modulated)	NI-CAD	24	Resembles wall outlet box. Wiring needed only on one side.
No. 1300L U.L.	S	200	Incandescent	Transmitter: Wet or Dry Cell	Wet Cell — 12 Dry Cell — ½	Also available in 300 foot range — add "-S" to cat. number. Add "-I" to cat. number for plug-in transformer.
No. 1356 U.L.	R	150	Pulsed Infrared	NI-CAD	16	Also available with straight 12VDC input, less batteries. Add "-12" to catalog number.

* = not shown

Assignment

- Read Chapter 12, pages 275-179 in Intrusion Detection Systems. Barnard, Robert L. Butterworth Publishers. Boston, 1981.
- Complete job sheet.
- Complete self assessment and check your answers.
- Complete post assessment and have instructor check your answers.

Job Sheet

- Obtain security equipment supply catalogs and product specification cut sheets.
- Select a photoelectric system for residential security from product information.
- List the following information on the system that has been selected.
  - Model
  - Range in feet
  - Application (indoor or outdoor)
  - Configuration (transceiver or transmittal/receiver)
  - Mounting (surface or recessed)
  - Housing (plastic, metal)
  - Operating voltage
  - Light source
  - Type of standby power
- Inspect a photoelectric system to compare the actual unit with the specifications that were planned for system.
  - How many of the specifications are shown on the unit?
  - What are the advantages and disadvantages of the system planned on paper compared to the one being inspected?

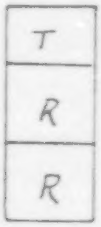
Self Assessment

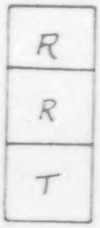
1. List three light sources for photoelectric systems.

2. Describe difference between active and passive infrared.

3. When are reflectors needed in an active infrared system?

4. Sketch in lines to show how light beams travel in a "stacked unit" setup.





5. Under what conditions does an LED show its light beam?

6. LED's will only produce light under a ______________ bias condition.

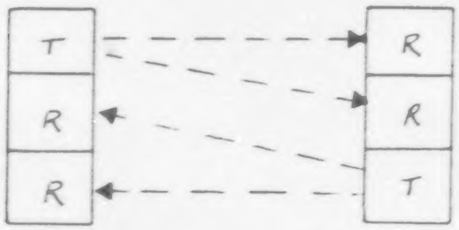
7. What is the operating life of LED's?

8. What are the problems with mirrors in system?

9. Which areas are best suited for photoelectric systems?

10. List one common application of photoelectric detection other than intrusion detection.

Self Assessment Answers

1. Pulsed infrared, LED's, incandescent light.
2. Active infrared uses a light beam between a transmitter and receiver. Passive infrared operates on thermal change due to the heat of the intruders body.
3. When a transceiver unit is used in system.
4. 

5. Fog or smoke conditions
6. Forward
7. Ten years. 10,000 hours when properly biased.
8. Misaligned and loose mirrors cause false alarms. Mirrors decrease range of system.
9. Entrances or routes to entrances.
10. Automatic doors, automated equipment.

Post Assessment

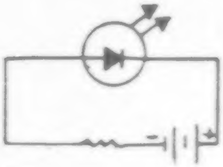
1. What is the disadvantage of incandescent light for intruder detection?

2. Show symbol of LED.

3. Is passive infrared a good light source for photoelectric systems?

4. What is the effect of fog or smoke on LED beams?

5. Is this system properly biased to provide a light beam?



6. Mirrors ________________ the range of a photoelectric system.
(increase,decrease)

7. An LED has an operational life of ____________ years.

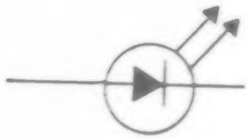
8. Photoelectric systems are best suited for the protection of ________________.

9. Photoelectric systems are best suited for ______________ range detection.
(long, short)

10. Sketch how a beam travels from transmitter to receiver when housed as a transceiver unit.

Instructor Post Assessment Answers

1. Beam is visible.

2. 

3. No

4. Makes beam visible.

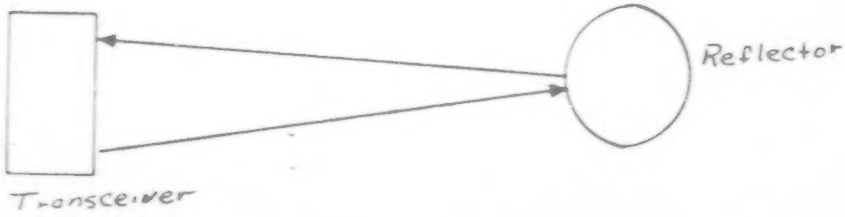
5. No

6. Decrease

7. Ten years

8. Entrances

9. Short

10. 
Reflector
Transceiver

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems. Butterworth Publishers. Boston, 1981.

INSTRUCTIONAL LEARNING SYSTEMS

12.2

PASSIVE INFRARED MOTION DETECTORS

Goal:

The apprentice will be able to describe passive infrared motion detection systems.

Performance Indicators:

1. Describe theory of passive infrared detection.
2. Describe components of a passive infrared system.
3. Describe the parts of an infrared detection system.
4. Read and interpret specifications for infrared systems.
5. Describe advantages of infrared as a volumetric motion detector.
6. Describe common problems in infrared application.

Study Guide

- Study the goal and performance indicators to find what is to be learned from package.
- Read vocabulary list to find the new terms to be found in package.
- Read introduction and information sheets.
- Read assignment (optional) Chapter 22 in Intrusion Detection Systems. Barnard, Robert. Butterworth Publishers. Boston. 1981. Pages 149-154.
- Complete job sheet.
- Complete self assessment and check answers with answer sheet.
- Complete post assessment and have instructor score results.

Vocabulary

- Field of view
- Passive infrared
- Protection patterns
- Refractive optical system
- Thermistor
- Variable resistor

Introduction

Passive infrared is rather new as a detection technology. It has been used in a variety of other applications in past years.

Infrared is a long wave length light. It is not visible to the naked eye. Passive infrared works on thermal changes in the environment. The system is balanced on the normal environment. Intruders add body heat to this environment and trip the balance of the sensor.

Passive infrared does not transmit energy. It merely responds to the energy created by the intruder.

Passive infrared is one of the easiest systems to install. It offers a range of detection patterns for space protection.

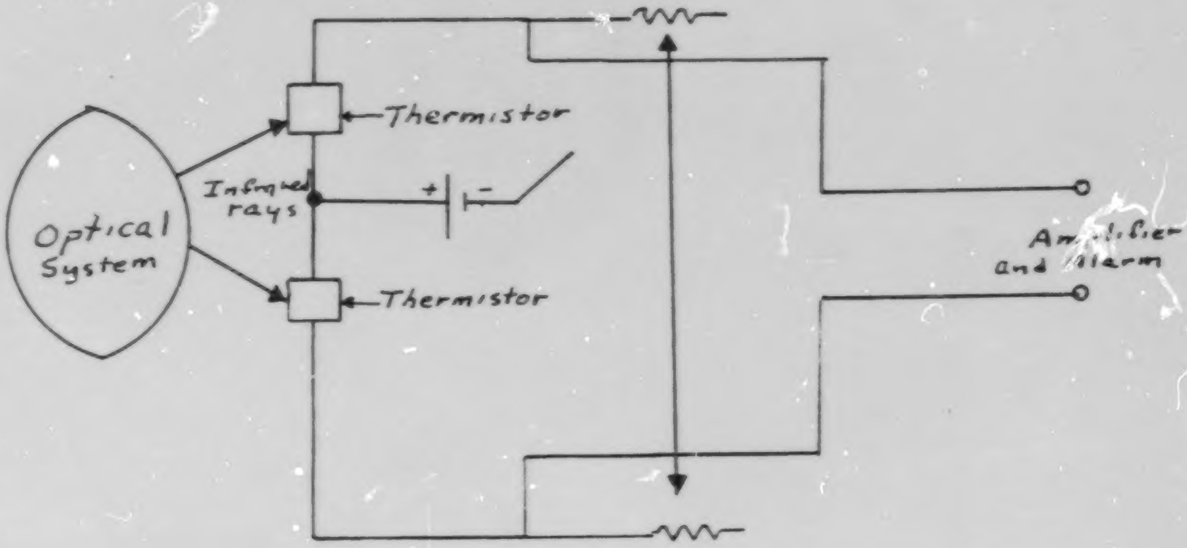
Information

Infrared is a form of light. It is not visible to the naked eye. Infrared is transmitted in a long wave length. All objects radiate infrared according to the temperature of the object. This includes both living and non-living objects.

Passive infrared does not require a return beam of light for its operation. That is why it is called passive. Active infrared that is used in photoelectric systems requires that a light beam travel from a transmitter to a receiver. A passive infrared detector responds to the heat that comes from the body of the intruder and not from the breaking of a light beam.

INFRARED DETECTORS

A detector views a specific area. It establishes a normal condition that is based on the infrared level of all objects wihtin that area. When an intruder enters the area, the infrared level is raised and the alarm is set off. Infrared will detect a man in total darkness at a distance of 1,000 feet. A truck can be detected at 2,500 feet. A circuit diagram of a passive infrared detector is shown:



Information

The infrared detector uses a type of resistor known as a thermistor. Thermistors have negative resistance which increases as the temperature goes down. The variable resistors allow the unit to be set up to balance the thermistor bridge circuit against the background of the area.

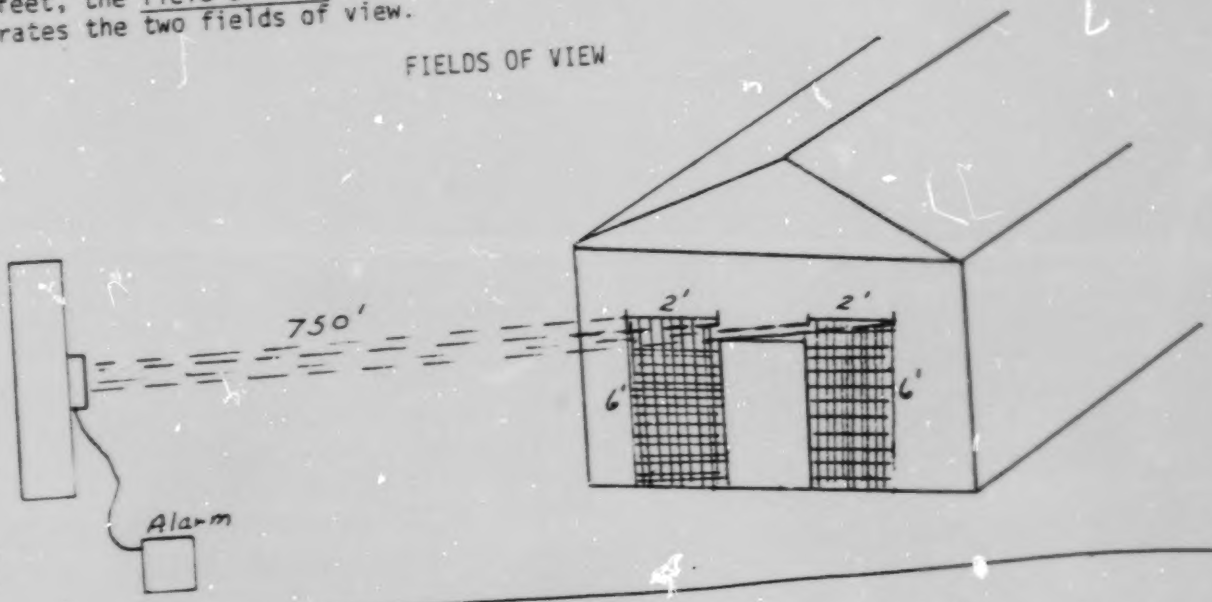
When in a balanced state, there is no current flow to the amplifier. One side of the bridge balances the other. When an intruder enters the field, the circuit becomes unbalanced. A signal is sent to the amplifier and the alarm goes off when the circuit becomes unbalanced.

PARTS OF INFRARED DETECTOR SYSTEM

The detector unit consists of a thermal sensor, signal processor and power supply--all contained in a single unit. Infrared detectors do not require as much power as active systems. In areas where AC is not available, battery powered DC will operate the system.

A refractive optical system provides each thermistor with its own field of view. At 750 feet, the field of view covers an area of two feet by six feet. An equal area separates the two fields of view.

FIELDS OF VIEW



Information

EXAMPLES OF SPECIFICATIONS OF INFRARED DETECTION ARE SHOWN BELOW.

PASSIVE INFRARED INTRUSION SENSORS
SELECTION CHART AND ACCESSORIES

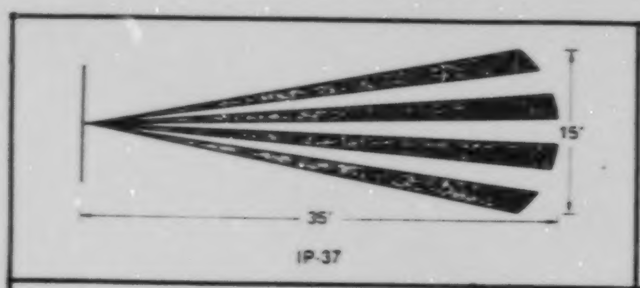
	IP-16	IP-18	IP-25	IP-50	IP-37	PIR-78	HA-99
Power Requirement	6-18VDC	9VDC	6-18VDC	6-18VDC	6-18VDC	9-18VDC/ 12VAC	6 "AA" Batteries
Mounting	Surface	Surface	Surface	Surface	Recessed	Surface	Surface
Coverage	25' x 35'	25' x 35'	20' x 25'	10' x 50'	15' x 35'	40' x 40'	15' x 25'
Built-in Standby Battery	Optional	NA	Optional	Optional	Optional	Optional 9V NiCad	NA
Alarm Output	SPDT	RF Transmission	SPDT	SPDT	SPDT	SPDT	SPDT
Enclosure	Plastic	Plastic	Plastic/ Metal	Plastic/ Metal	Plastic Metal	Metal	Plastic/ Woodgrain

ACCESSORIES

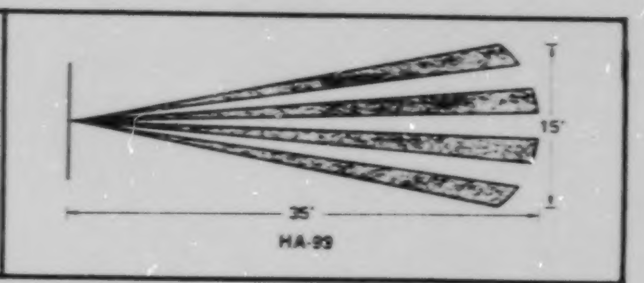
PS-1R	Power Supply, 6VDC, 1.2AH (All sensors except IP-18, PIR-78, HA-99).
PS-2R	Power Supply, 12VDC, 1.2AH (All sensors except IP-18, PIR-78, HA-99).
PIR-78B	Rechargeable Standby Battery, 9V NiCad (PIR-78).
PIR-78T	Transformer, 12VAC, 10VA, use with PIR-78B (PIR-78).

Information

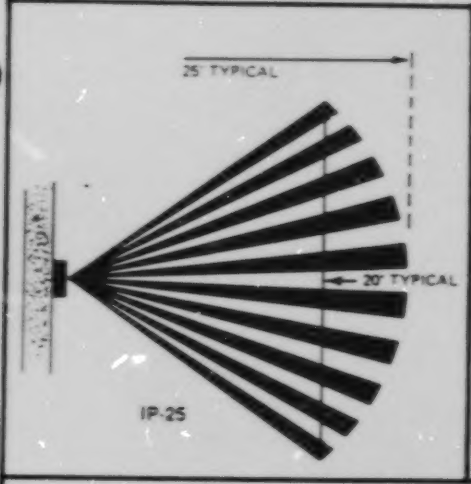
EXAMPLES OF PROTECTION PATTERNS OF INFRARED DETECTION ARE SHOWN BELOW.



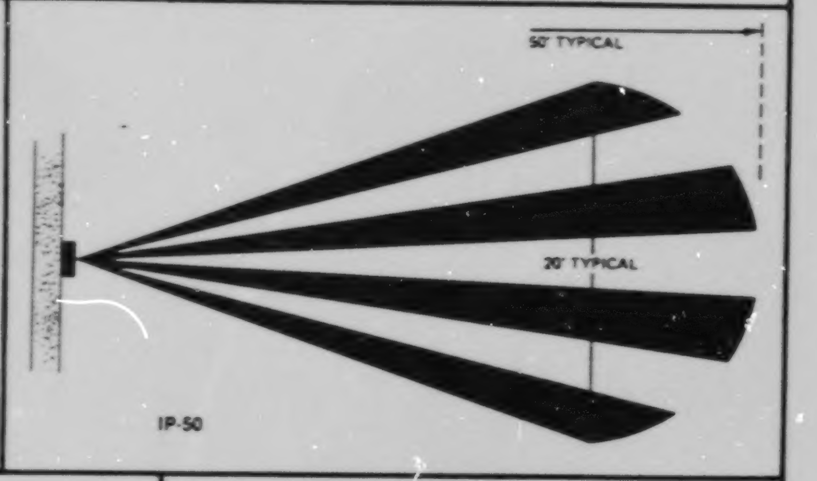
IP-37



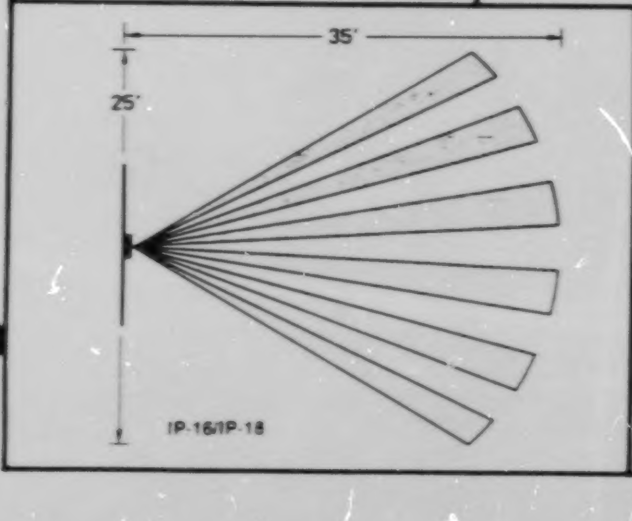
HA-99


25' TYPICAL
20' TYPICAL

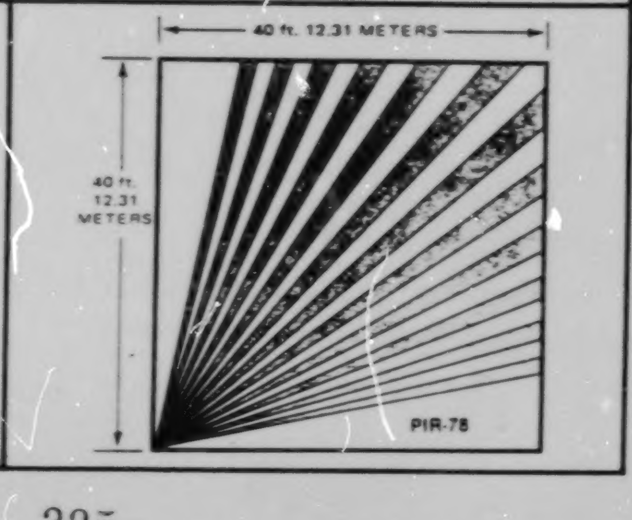
IP-25


50' TYPICAL
20' TYPICAL

IP-50



IP-16/IP-18


40 ft. 12.31 METERS
40 ft. 12.31 METERS

PIR-78

Information

ADVANTAGES OF PASSIVE INFRARED

- Passive infrared does not transmit energy of any kind. Interference between detector units will not harm humans or pets.
- Infrared does not creep into other areas. Any physical barrier will stop infrared. This eliminates false alarms caused by movement in surrounding areas.
- The protection pattern is easy to control. The optical system can be adjusted to allow small pets to enter the area without triggering the alarm.
- Infrared will not false alarm because of moving air. It cannot see air.

PROBLEM AREAS

- Birds and flying insects can cause false alarms.
- Heat sources such as radiators, heaters, hot pipes can cause problems. The detector should never be located near heat sources.
- Hot spots in the field of view can cause false alarms. Sunlight filtered through glass or unshielded lights can create hot spots.

Assignment

- Optional reading assignment:

  Intrusion Detection Systems. Barnard, Robert.
  Butterworth Publishers, Boston, 1981.
  Pages 149-154.

- Complete job sheet
- Complete self assessment
- Complete post assessment

Job Sheet

- Inspect passive infrared intrusion detector system.
- Identify components of system.
    - Sensor
    - Signal processor
    - Power supply
- Make a schematic that shows electronic components of system. Use standard symbols.
- Make a block diagram of system.

Self Assessment

1. Thermistors are a type of ______________________.

2. Which component is used by the installer to adjust for the background area?

3. Can passive infrared beams (under special conditions) be viewed with the naked eye?

4. What is the purpose of the refractive optical system?

5. Do objects other than man and animals radiate infrared?

6. How is infrared affected by the movements of air?

7. List three sources of problems in passive infrared systems.

8. Is there a problem with passive infrared in "creeping" through walls into other areas?

9. List three major parts of an infrared detector unit.

10. What is a field of view?

Self Assessment Answers

1. Resistor

2. Adjustable resistors

3. No

4. To help each thermistor to set up their own fields of view.

5. Yes

6. Infrared cannot see air. It is not bothered by air movements.

7. Birds and flying insects, heat sources such as radiators. Hot spots from glass filtered sunlight.

8. No. It will not pass through walls.

9. Thermal sensor, signal processor, power supply.

10. The protection area for each thermistor. At 750 feet, the field of view is 2' x 6'.

Post Assessment

1. What is a thermistor?

2. Why are adjustable resistors used in passive infrared sensors?

3. Does passive infrared detectors transmit energy?

4. What is the difference between active and passive infrared?

5. Where is the thermal energy generated to set off the alarm system?

6. What is a field of view?

7. List three advantages of passive infrared.

8. What precaution should be made in regard to sunlight in setting up detectors?

9. What precaution should be made in regard to heat sources (radiators, hot pipes) in setting up detector?

10. What types of objects radiate infrared?

Instructor Post Assessment Answers

1. A type of resistor.

2. To balance the infrared value of background with system. The intruder brings additional infrared and upsets balance.

3. No

4. Active infrared sends a beam of light from a transmitter to a receiver. Passive infrared merely responds to the heat of an intruder's body.

5. By the intruders body.

6. The protected area covered by each thermistor. An example would be to set the fields of view on each side of a door.

7. a) Does not creep into other areas
   b) Protection pattern easy to control
   c) Will not false alarm because of air movements

8. Avoid facing detector toward filtered sunlight. It can cause false alarms.

9. Avoid placing detector near heat sources. It will cause false alarms.

10. All objects radiate infrared. Both living and non-living objects.

Supplementary References

* Barnard, Robert L. *Intrusion Detection Systems: Principles of Operation and Applications*. Butterworth Publishers. Boston. 1982. Chapter 11, Pages 149-154.

iLS

INSTRUCTIONAL LEARNING SYSTEMS

12.3

MICROWAVE DETECTORS

(RADAR)

Goal:

The student will be able to describe radar (microwave) detection systems and their application.

Performance Indicators:

1. Describe how microwave detectors operate.
2. Describe microwave patterns.
3. Describe how antennas control protection pattern shapes.
4. Describe applications of microwave as a volumetric motion detector.

Study Guide

- Read the goal and performance indicators to find what is to be learned from package.
- Study the vocabulary list to find the new terms to be introduced.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post test and ask instructor to check answers.
- Read pages 137-146 in the supplementary reference.

Vocabulary

- Antenna
- Directional antennas
- Doppler shift
- Omni-directional antennas
- One piece radar
- Power supply
- Radar
- Signal processor
- Two piece radar
- Volumetric motion detector

Introduction

Radar received its first heavy use in World War II. Since that time, many applications of radar have been made. For example, radar is used by the police to detect speeders on the highways.

The FCC has allocated five operating frequencies to be used for security alarm purposes. All five of those frequencies fall within the microwave frequency range. When people refer to the use of radar in security alarms, they probably mean microwave applications.

Microwave is used as a microwave energy beam between a transmitter and receiver. When the energy beam detects the motion of an intruder, the alarm is sounded. In such applications, microwave is an invisible beam detector or two-piece radar. Microwave applications in invisible beam detectors is discussed in a separate package.

Microwave is also used as an active volumetric motion detector. This package will emphasize its application as a volumetric device. In this application, a one piece transceiver is utilized. So this becomes a one-piece radar application.

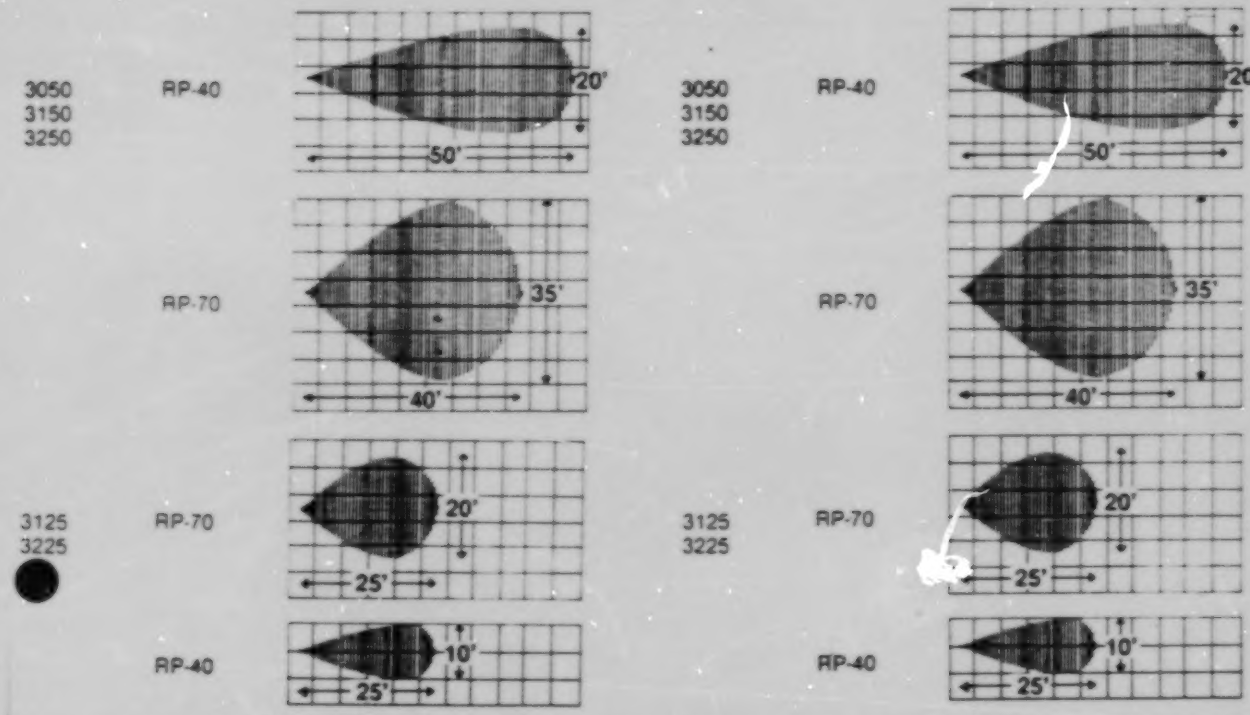
Information

Microwave detectors are self-contained units that includes an antenna, signal processor and power supply. These detectors send out electromagnetic energy in a pattern. When an intruder moves into this field of microwave energy, the system will alarm. The system works on the principle of the Doppler frequency shift. Intruders change the frequency by their presence.

Microwave energy has the ability to pass through walls of wood, glass and non-metallic substances. For this reason, one must be careful of the placement of microwave detectors. If there is movement on the street, the microwave is apt to pick it up and false alarm. Birds, blowing trees and grass will also create false alarms.

Most microwave systems operate on a frequency of 10,525 MHz. The shape of the microwave pattern is controlled by the antenna. The antennas may be omni-directional [illegible] directional. Omni-directional antennas create a circle type pattern. The directional antenna make broad, tear-shaped patterns and long narrow patterns. Some typical protection patterns are shown below:

PROTECTION PATTERNS


3050
3150
3250
RP-40
20'
50'
RP-70
35'
40'
3125
3225
RP-70
20'
25'
RP-40
10'
25'
3050
3150
3250
RP-40
20'
50'
RP-70
35'
40'
3125
3225
RP-70
20'
25'
RP-40
10'
25'

Information

Volumetric motion detectors are self-contained units. The transceiver houses both transmitter and receiver for the detector. Also, it contains the power supply, antenna and signal processor. For this reason, the unit is called one-piece radar. When used with separate transmitter and receiver (invisible beam applications) it is two-piece radar.

The protection coverage of a microwave unit can be controlled by antenna selection. The units can be purchased with a choice of antennas.

SELF-CONTAINED MICROWAVE INTRUSION DETECTORS

	2500	2400	2600	2067	2069	2054
Classification	Self-Contained	Self-Contained	Self-Contained	Self-Contained	Self-Contained	Self-Contained
Coverage (Standard Antenna)	25' x 20' (RP-70)	50' x 20' (RP-40)	100' x 40' (RP-40)	200' x 40' (RP-40)	300' x 60' (RP-40)	75' x 40' (RP-40)
Coverage (Optional RP-20 Antenna)	NA	50' x 10'	100' x 20'	NA	NA	NA
Coverage (Optional RP-70 Antenna)	NA	40' x 35'	100' x 70'	NA	NA	NA
Operating Voltage	12VAC	12VAC	12VAC	12VAC	12VAC	12VAC
Transformer (Required Option)	1091	10[illegible]	1091	1091	1091	1091
12VDC Rechargeable Standby	Standard	Standard	Standard	Standard	Standard	Standard
Walk Test Light	Yes	Yes	Yes	Yes	Yes	Yes
Available Transmitting Frequencies	4	4	4	4	4	4
Tamper Proof Enclosure	Yes	Yes	Yes	Yes	Yes	No
Mounting	Wall Bracket (included)	Wall Bracket (included)	Wall Bracket (included)	Battery Enclosure	Battery Enclosure	Shelf, Desk, etc.
UL Listed	Yes	Yes	Yes	Yes	Yes	No

NA = Not Available

APPLICATIONS

The installer should consider these points in working with microwave systems.

1. Broad protection patterns are selected for large areas.
2. Long, narrow patterns are suited for protection of corridors.
3. Microwave can penetrate most walls and detect motion on the other side. For this reason, the installer must consider the placement of the unit very carefully.

Information

4. Metal objects reflect microwave energy. Christmas ornaments are known to create many false alarms. Only metal objects make problems for microwave.

5. Microwave detectors should never be pointed toward moving metal objects such as fan blades and rotating machinery.

6. Microwave is not affected by moving air masses.

7. The manufacturer's recommendations should be followed in making microwave installations.

Assignment

- Read pages 137-146 in supplementary reference.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete post assessment and have instructor check answers.

Job Sheet

INSPECT A MICROWAVE DETECTOR UNIT

- Obtain a microwave unit and manufacturer's specifications for unit.
- Study the specifications for the unit.
  - What type of power supply is needed?
  - What type of antenna does it have?
  - What is the size and shape of the protection pattern?
  - What precautions and warnings are offered by the manufacturer?
  - What type of antenna does the unit have?
- Inspect several models if time allows and the units are near at hand.
  - What are the differences between units?

Self Assessment

1. What are the two major uses of microwave in the security alarm field?

2. Which application of microwave is known as one-piece radar?

3. The ______________ frequency shift is the principle on which microwave detection is founded.

4. The FCC has assigned ____________ frequencies for the operation of radar in private business.

5. What type of protection patterns are created by omni-directional antennas?

6. Why are metal objects a problem in microwave systems?

7. Can microwave pass through wood or glass walls?

8. What is the difference between one and two-piece radar units?

9. Is microwave affected by the movement of air?

10. Microwave sends out _____________ energy.

Self Assessment Answers

1. Volumetric motion detection and as a beam.
2. Volumetric motion detection.
3. Doppler frequency shift.
4. Five
5. Short, round patterns.
6. Metal reflects microwave in the same way that a mirror reflects light.
7. Yes
8. One-piece radar uses a transceiver unit which includes all parts of the system. Two-piece radar has separate transmitter and receiver units.
9. Metal reflects microwave much as a mirror reflects light.
10. Yes. Very definitely. It is a major consideration in using microwave systems.

Post Assessment

1. Describe one and two-piece radar units.
2. Why are radar and microwave the same in security alarm systems?
3. What controls the shape of the protection pattern of microwave?
4. Who sets the frequency levels for the operation of microwave units?
5. Which frequency level is most common in detection systems?
6. Microwave detection is based on teh principle of the ___________ frequency shift.
7. Why are surrounding walls important in setting up microwave systems?
8. What types of protection pattern is provided by an omni-directional antenna?
9. What type of pattern is provided by a directional antenna?
10. How many frequency levels are available for microwave systems?

Instructor Post Assessment Answers

1. One-piece radar uses a transceiver unit to house the total unit. Two-piece radar uses separate transmitters and recievers.

2. The only frequencies allowed fall within the microwave range.

3. Antenna

4. FCC

5. 10,525 MHz

6. Doppler

7. Microwave can pass through wood and glass and pick up motion on the other side. This causes false alarms.

8. Circle type

9. Broad tear shaped and long narrow patterns.

10. Five

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

12.4

STRESS DETECTORS
IN SPACE AND VOLUMETRIC APPLICATIONS

Goal:

The apprentice will be able to describe stress (vibration) detectors and their application in space and volumetric protection.

Performance Indicators:

1. Describe structural vibration detectors and their applications.
2. Describe glass breakage sensors and their applications.
3. Describe two basic types of transducers used in vibration detectors.
4. Describe spring-loaded and unrestricted seismic masses.
5. Describe the use of pulse count circuits in structural vibration and glass breakage sensors.

Study Guide

- Read the goal and performance indicators to find what should be learned from the package.
- Study the vocabulary page to see the new words that will have to be learned in package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete self assessment and check answers with answer sheet.
- Complete post assessment and ask instructor to check answers.

Vocabulary

- Adjustable pulse counting device
- Bonded wire strain gauge
- Coaxial cable
- Electret cable transducer
- Foil tape
- Geophone transducer
- Mechanical contact switch transducer
- Piezoelectric crystal
- Piezoelectric transducer
- Seismic mass
- Shielded cable
- Spring loaded seismic mass
- Strain gauge
- Structural vibration detector
- Transducer
- Unrestricted seismic mass

Introduction

Many security systems use vibration sensors to protect ceilings, walls and windows. Vibration sensors convert the vibrations of window breaking and wall smashing into electrical signals.

The basic device in vibration sensors are transducers. A transducer is a device that converts one form of energy into a different form. In this case, the transducer converts vibrations into electrical signals.

Other types of stress sensors are foil tape, to detect window breaking, and fence sensors. A separate package will be devoted to the sensors used in fence protection. For that reason, it will be treated lightly in this package.

Information

Vibration detectors are of two types:

1. Low frequency for detection of structural vibrations.
2. High frequency for detection of breaking glass.

Each type of detector responds to the vibrations of an intruder that is breaking into the protected area.

STRUCTURAL VIBRATION DETECTORS

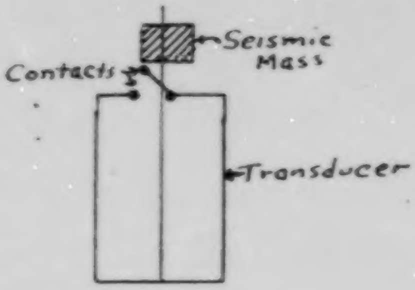
The structural vibration detector is used to protect the walls around an area. When an intruder smashes in a wall, the low frequency vibrations will set off an alarm.

Transducers are used to sense low frequency vibrations. A transducer is a device that converts energy from one form to another. In this case, it converts energy from vibrations into electrical energy. There are two types of transducers used in vibration sensors. These are:

1. Mechanical contact switch transducers
2. Piezoelectric transducers

MECHANICAL CONTACT SWITCHES

The mechanical switch transducer uses a seismic mass to make a connection of the switch contacts.



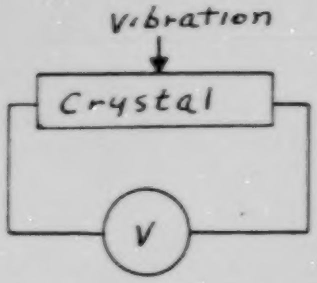
When a vibration occurs, the seismic mass is bounced upward along a vertical axis. When it falls back of its own weight, it closes the contacts. The size

Information

of the mass and contact spacing will determine the level of vibration needed to alarm. The seismic mass may be a part of a movable switch contact. Some mechanical switches use spring-loaded seismic mass. That type of mass must depend on the spring-loaded switches to close the contacts. Unrestricted seismic mass depends upon the weight of the mass to close the switch. Spring-loaded switches can be mounted in any position on the wall. Unrestricted mass switches must always be mounted in a vertical position so that the mass will fall down to close the switch. Mechanical contact switches are difficult to adjust. The screw adjustment makes it difficult to set the sensor to alarm at the desired level.

PIEZOELECTRIC TRANSDUCERS

A piezoelectric transducer uses a piezoelectric crystal to measure vibration.. The piezoelectric electric crystal is usually made of quartz. When it is compressed, a voltage is produced.



When an intruder tries to break a wall, the vibration puts pressure on the crystal and voltage is produced. The piezoelectric transducer is mounted directly to the wall being smashed. The transducer signal is amplified and sent to the signal processor. Shielded or coaxial cables must be used to protect the low voltage signal from outside interference. The shielded cable will help the system from false alarming to outside interference. An adjustable pulse counting device can be used to keep the transducer from alarming on single vibrations.

APPLICATIONS OF STRUCTURAL VIBRATION SENSORS

Vibration transducers are usually installed every 10 feet along the wall to be protected. The transducers must be firmly attached to the structure. External vibrations may cause false alarms. These false alarms can be reduced by using pulse count circuits. Pulse count circuits prevent alarming due to accidental vibrations. The installer must consider what will be required to break through the wall when setting the pulse count circuit. Vibration detectors are used to protect walls and ceilings during forced entry by an intruder.

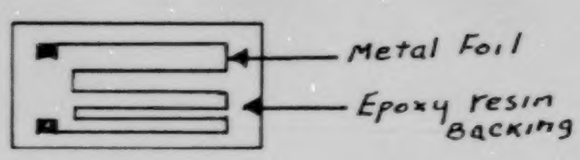
Information

GLASS BREAKAGE DETECTORS

Glass breakage detectors work very much like structural vibration detectors. Both mechanical contact switches and piezoelectric transducers are utilized as sensors. The transducers are set to respond to high frequency vibrations such as the breaking of glass. Pulse count circuits are not used with glass breakage detectors. The alarm must go off with the first vibration. Detectors are mounted in the corners of windows. They must be fastened securely to the glass. One transducer is used for each 100 square feet of glass. Care must be given to the type of adhesive used to fasten the transducers to the glass. It must be able to withstand extreme temperatures and condensation. If the adhesive fails, the transducer will become loose and fail to alarm.

OTHER TYPES OF STRESS DETECTORS

Foil tape is used for window protection. It is a metalized conductive tape. The tape is applied around the outside edges of a window and hooked to a terminal or one corner. During glass breakage, the foil tape is cut and the alarm is set off. A balanced bridge circuit in the signal processor monitors the signals and alarms when the tape is cut. Foil tape is a strain gauge transducer made of a metal foil of 3μm thickness.



This transducer is also called the bonded wire strain gauge.

FENCE SENSORS

There are several types of fence sensors that operate on electromechanical and piezoelectric transducers. Another type uses geophone transducers to convert mechanical vibrations into electrical signals. The electret cable transducer uses special coaxial cable to convert stress into electrical energy. The taut-wire switch is used as a sensor for barb wire fence. The different types of fence sensors will be discussed in more detail in a later package on fence security.

Job Sheet

INSTALL A GLASS BREAKAGE DETECTOR

- MATERIALS NEEDED
  - Transducer (glass protection)
  - Signal processor
  - Power supply
  - Manufacturers specifications and diagrams
- PROCEDURES
  - Connect wires to transducer
  - Attach transducer to window
  - Connect wires to signal processor
  - Connect with power supply
  - Adjust transducer according to manufacturers specifications
  - Test to determine if it will alarm

NOTE: Use materials that are available at your work site. Follow manufacturers specifications in matching the sensor, signal processor and power supply.

Assignment

- Obtain a security supply catalog such as the one published by Wm. B Allen Supply Co., Inc.
- Look at sensors, control units and other accessories for shock detection, stress detection and glass protection.
- Identify the components needed for protecting the perimeter of your house. This might include protection for the walls, windows, doors and ceilings.

Self Assessment

1. The basic sensing device for a vibration sensor is called a ______________.

2. Vibration sensors convert the energy from vibrations into __________ energy.

3. A structural vibration detector is designed for protecting the __________ of a building.

4. Transducers sense ___________ frequency vibrations in structural detectors. (high, low)

5. Piezoelectric transducers operate on a ____________ crystal.

6. A __________ cable is used to shield the low voltage signal of a piezoelectric from outside interference.

7. An __________ pulse counting device is used to keep the transducer from alarming on every single vibration.

8. An unrestricted mass transducer is dependent upon the weight of the mass to close the switch.

9. ________ ________ detectors use pulse counting circuits to reduce false alarms.

10. One glass breakage sensor is used for each _______ square feet of glass.

Self Assessment Answers

1. Transducer
2. Electrical
3. Walls
4. Low
5. Quartz
6. Coaxial or shielded
7. Adjustable
8. True
9. Structural vibration
10. 100

Post Assessment

1. What are the sensor devices for vibration detectors called?

2. What closes the switch in a mechanical switch transducer?

3. What is the job of a transducer?

4. What is the name of the transducer that gets its signal by squeezing a quartz crystal?

5. Why should the signal from that quartz crystal be transmitted in shielded or coaxial cable.

6. Which detector (structural vibration or glass breakage) needs a pulse counting circuit?

7. How many square feet of glass can be protected by one sensor?

8. How does an unrestricted seismic mass close a switch?

9. Structural vibration sensors are installed every _____ feet along a wall.

10. Are piezoelectric transducers used as glass breakage sensors?

Instructor Post Assessment Answers

1. Transducers
2. Seismic mass
3. Convert energy from one form to another
4. Piezoelectric
5. To protect it from outside interference
6. Structural vibration sensor
7. 100
8. By its own weight
9. 10
10. Yes

Supplementary References

- Barnard, Robert L. Intrusion Detectors: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

12.5

CAPACITANCE DETECTORS

Goal:

The apprentice will be able to describe capacitance detectors and their applications.

Performance Indicators:

1. Describe how capacitance detectors work.
2. Describe the adjustments of a capacitance detector system.
3. Describe procedures for installing capacitance detectors.
4. Describe needs for quick response to alarm.

Study Guide

- Read goal and performance indicators to find what is to be learned from package.
- Read vocabulary list to become acquainted with new terms that will be introduced in package.
- Study introduction and information sheets.
- Complete self assessment and check answers with answer sheet.
- Complete post assessment and have instructor score answers.

Vocabulary

- Capacitor
- Capacitance detector
- Dielectric medium
- Electrical ground plane
- Electrostatic field
- Insulated blocks
- Proximity sensors
- Reactive component

Introduction

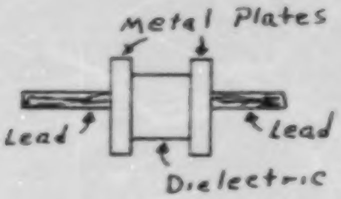
Capacitance detectors are called proximity sensors. They will detect anyone that approaches or touches the items being protected. Capacitance detectors are used in high value storage areas such as metal filing cabinets and safes.

The detection results as a change in capacitance between the metal item and the electrical ground plane under the item. These detectors can also be used in protecting highly valuable items such as paintings by mounting them on a metal surface.

The use of capacitance detectors require that the detectors be isolated from the ground plane. Safes and filing cabinets must be placed on insulated blocks to isolate them from the ground plane.

Information

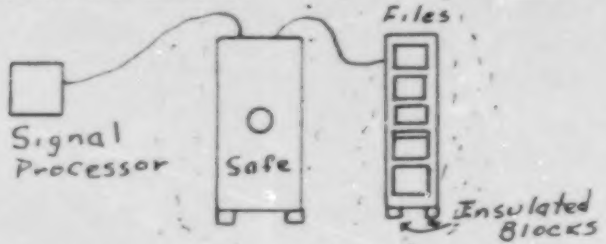
A capacitor is a reactive component. It is reactive because it does not allow current to flow through it. It is a storage device because it can store an electrical charge for use at a later date. The ability of a capacitor to hold a charge comes from its basic construction. Actually, the capacitor is a sandwich made by placing an insulator between two conductors.



The insulator portion of the sandwich is called the dielectric medium. The conductors move electrons until they reach the dielectric. The dielectric will not allow the electrons to move between the conductors (metal plates). Electrons are stored in the plates when the capacitor is charged. Capacitors will charge up to that voltage being applied to it.

CAPACITANCE DETECTORS

A change in the dielectric medium will change the capacitance between the two plates. The detector represents the two metal plates of the capacitor. The object being protected is one metal plate and the electrical ground around the item represents the second metal plate. The protected item is placed on insulated blocks to isolate the two plates. The air between the plates is the dielectric medium.



Electrostatic field that acts as the dielectric medium.

Information

An electrostatic field is developed by charging the metal items. The electrostatic field exists between the protected items and the electrical ground reference. An intruder changes this field with the electrical conductivity of their own body.

ADJUSTING THE DETECTOR

Capacitance detectors should be adjusted to detect intruders when they come within six inches of the protected item. This means that the intruder is either touching or about to touch the item. This level of response reduces the number of false alarms. The capacitance detector is affected by changes in humidity as it changes the dielectric medium's (air) conductivity. When metal objects are moved near the protected area, the electrostatic field will be changed. The detector should be adjusted at seasonal changes or after metal objects have been moved near them. Such adjustments are necessary if the sensitivity of the detector is to be maintained.

SIGNAL PROCESSOR

The capacitance detector signal processor is a balanced bridge circuit. The metal item being protected is a part of that circuit. Bridge circuits can be adjusted manually or automatically. An automatic or self-balancing circuit is preferred for capacitance detection systems.

INSTALLATION OF ALARM SYSTEM

A proximity detector is easy to install. The signal processor is attached to a wall near the protected area. One wire is attached to the protected item and the other is attached to a water pipe for the electrical ground reference. The metal item is isolated from the ground reference with insulated blocks. After hookup is made, the alarm is tuned by turning a set screw until the level of protection is set. Most proximity detector systems operate from AC plug-ins with a built-in transformer and backup battery systems. Some operate form 1.5V dry cell batteries.

APPLICATIONS

Capacitance detectors are used in the innermost zones of protection. The intruders actually have their hands on or very near the protected items before the alarm

Information

goes off. It is important that these detectors be used when a quick response can be given. This should be considered in the design of the system.

Assignment

- Inspect a signal processor for a capacitance detector system.
- Read assignment in supplementary reference. Pages 181-185.
- Complete self assessment and check answers with answer sheet.
- Complete post assessment and have instructor check your answers.

Self Assessment

1. Capacitance detectors are also called ________________ sensors.
2. A capacitor is a ____________ component.
3. The dielectric medium is an ____________________.
4. The metal plates of a capacitor are __________________.
5. In operation, the metal item being protected represents one _________ of a capacitor.
6. The dielectric medium is represented by ____________ in an operational system.
7. The ___________ field is developed by charging the protected items.
8. Why is it important to set the metal items on insulated blocks?
9. The detector should be adjusted to alarm when the intruder is within ______________ of the protected item.
10. The signal processor for capacitance detection systems operates on a balanced ____________ circuit.

Self Assessment Answers

1. Proximity
2. Reactive
3. Insulator
4. Conductors
5. Plate
6. Air
7. Electrostatic
8. To siolate the item from the electrical ground reference.
9. 6"
10. Bridge

Post Assessment

1. A capacitor has two metal plates with an insulator sandwiched between them. What is the insulator called?

2. What type of circuit is used for the signal processor of a capacitance detector?

3. How is the electrostatic field developed?

4. What types of items are protected by capacitance detectors?

5. A capacitor does not allow current to flow through. For that reason it is called a _______________ component.

6. Proximity detectors should be set to alarm when intruders are within _________________________ of the protected items.

7. Why is a quick response time necessary for capacitance detection?

8. __________________ is used as the dielectric medium for capacitance detectors.

9. How are the two electrical fields of a capacitance detector isolated from each other?

10. What is a proximity sensor?

Instructor Post Assessment Answers

1. Dielectric
2. Balanced brige circuit
3. By charging the metal plates
4. High value items such as safes
5. Reactive
6. 6 inches
7. Because the intruder is very near or have their hands on the protected item.
8. Air
9. By setting the protected metal items on insulated blocks.
10. A sensor that alarms when the intruder is very near the protected item.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers, Boston, 1981.

INSTRUCTIONAL LEARNING SYSTEMS

12.6

SOUND DISCRIMINATION

Goal:

The apprentice will be able to describe sound discrimination in security applications.

Performance Indicators:

1. Describe sound discrimination.
2. Describe problems with sound discrimination as a detection device.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list.
- Study the introduction and information sheets.
- Complete the self assessment.
- Complete the post assessment and have instructor check your answers.

Vocabulary

- Audio discriminator
- Filters
- Noise threshhold
- Sound discrimination

Introduction

Sound discrimination differs from other audio detection systems that merely listen in to the sounds of an intrusion. Through the use of filters in the amplifier, discriminators are designed to ignore normal background sounds and react to the sounds of intrusion.

Sound discrimination systems have a lot of problems with false alarms. The discriminators cannot sort out all background noise from the noise of intrusion. For this reason, sound discrimination has limited applications in security alarm systems.

Information

A sound discrimination system uses filters in the amplifier to discriminate sounds. These systems are designed to ignore normal background sounds. They are set to alarm when an intruder breaks and enters.

Audio discriminators can be purchased in stand/alone units or as a module for central reporting systems. Sound discrimination differs from other types of audio detectors which listen to the sounds of the protected area. The filters are supposed to screen out background sound.

The sound discriminator has problems with false alarms. It must be carefully tested to avoid false alarms from unusual background noises. Barking dogs, telephones, cars and playing children can make unusual noises that will false alarm the system. It is difficult to adjust the system to handle the unusual noises that may occur. There are no standards for sound testing of equipment. Each installer must come up with their own tests such as breaking sticks to adjust the noise threshhold.

Sound discrimination systems consist of a microphone, amplifier and relay. The amplifier has discriminators that screen the sound. These discriminators are filters.

Assignment

- Read pages 205-207 in supplementary reference.
- No job sheet.
- Complete the self assessment.
- Complete the post assessment and check answers with instructor.

Self Assessment

1. Audio discriminators use ______________ in the amplifier to screen out normal background noises.

2. How do sound discriminators differ from other audio detection systems?

3. What is the biggest problem in the use of audio discriminators as detection devices?

4. In what forms are audio discriminators purchased?

5. What are the standards for testing audio discriminators?

Self Assessment Answers

1. Filters

2. Other audio systems "listen in" while discriminators are supposed to screen out normal background noise and alarm when an intrusion is made.

3. False alarms due to unusual background noises such as playing children, telephones, cars, etc.

4. Stand alone units and modules.

5. There are no standards for testing. Each installer must develop their own.

Post Assessment

1. What is the cause of false alarms in audio discrimination devices?

2. How is the "noise threshhold" adjusted on sound discriminators?

3. What is the purpose of filters in audio discriminators?

4. What are the parts of a sound discrimination system?

5. How does a sound discriminator differ from other audio detection systems?

Instructor Post Assessment Answers

1. Unusual noises that have not been allowed for in adjustment of the discriminators. Playing children, cars, whistles are good examples of unusual noises that are not caused by an intruder.

2. Each installer must devise their own test standards for setting the threshhold for discrimination. Breaking a stick might be one example.

3. To screen out normal background noise from that of intrusion.

4. Microphone, amplifier and relay.

5. Other audio detectors "listen in" on intrusion sounds. Discriminators screen out normal background sounds and alarms on intrusion sounds.

Supplementary References

- Trimmer, H. William. *Understanding and Servicing Alarm Systems*. Butterworth Publishers. Boston, 1981.

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INSTRUCTIONAL LEARNING SYSTEMS

12.7

ULTRASONIC MOTION DETECTORS

Goal:

The apprentice will be able to describe ultrasonic motion detection devices.

Performance Indicators:

1. Describe the theory of ultrasonic sound frequencies and the "Doppler Effect."
2. Describe advantages and disadvantages of transducers vs. transceivers.
3. Describe performance considerations of ultrasound.
4. Describe patterns of coverage.
5. Describe considerations in selecting an ultrasonic system for a job.
6. Describe the main parts of an ultrasonic detection system.

Study Guide

- Study goal and performance indicators to see what is to be learned from module.
- Read introduction and information sheets.
- Study supply catalogs and other materials that show specifications of ultrasonic devices.
- Complete job sheet if equipment is available.
- Complete self assessment and check against answer sheet.
- Complete post assessment and have instructor check answers.

Vocabulary

- Coverage pattern
- Doppler effect
- Doppler shift
- Hertz unit (Hz)
- Receiving transducer
- Transceiver
- Transmitting transducer
- Ultrasonic
- Ultrasound
- Zone annunciator panel

Introduction

Ultrasonics is one of the best methods for protection of interior space. It is an easy system to install and monitor.

The installer should understand the basic principles of ultrasonics and the best applications to be made in its use as a detection device. With such knowledge the installer can design systems that work well over a long period of time.

Information

THEORY OF ULTRASONIC DETECTION

Ultrasonics is the science of ultrasound. Ultrasound is sound at a frequency above the range of human hearing. The normal range of human hearing is 15,000 to 20,000 hertz (Hz) units. Ultrasound is greater than 20,000 hertz frequency. Ultrasonics is used for indoor intrusion detectors. It provides an economical and effective detection system.

The operating principle of ultrasonics is the "Doppler Effect." The "Doppler Effect" can be explained by this example. A low flying plane makes a high pitched whine as it approaches. After the plane passes the sound is of much lower frequency. The approaching sound is the result of the engine sound plus the speed of the plane. The departing sound is the engine sound minus the speed of the plane. This change in frequency is called the "Doppler Shift." If the source and listener are standing still, the frequency is equal to the sound of the source. When the source and listener move toward each other, the frequency increases. When they move apart, the frequency decreases. Ultrasonic detectors use the "Doppler Effect" to perceive motion in a protected space.

A transmitting transducer is used to convert electrical energy to sound energy. The transmitting transducer sends out ultrasonic waves which bounce off furniture, walls, floors and other stationary objects. These waves reach a receiving transducer at the same frequency as transmitted. The receiving transducer converts the sound energy back into electrical energy. A moving object such as an intruder will cause the frequency to become even higher or lower than that of the source. These "Doppler Shift" frequencies will be picked up by the receiving transducer. An ultrasonic alarm system is set so that the "Doppler Shift" frequencies will trigger an alarm signal. A single unit that contains both transmitting and receiving transducers is called a transceiver.

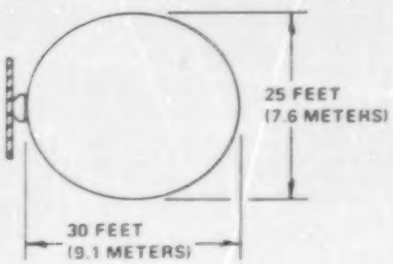
TRANCEIVERS VS. TRANSDUCERS

The installer has a choice of whether to use a transceiver or two individual transducers. Transceiver units are easier to wire but do not give as complete a coverage as transducers. Individual transducers give more uniform coverage and sensitivity than transceivers. The nature of the area to be covered will determine whether individual transducers should be used.

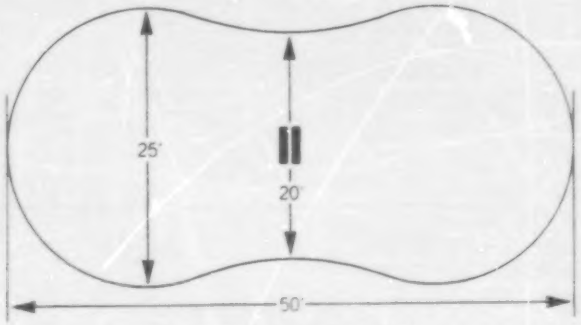
PATTERNS OF COVERAGE

Transducers and transceivers come in many shapes and sizes. A variety of coverage patterns are available. These include narrow, wide and omni-directional coverage patterns. The specifications of some detector units are shown in the following selection chart. The protection patterns are matched up with the specifications.

PROTECTION PATTERNS



101/140 SERIES



148 DOUBLER (CEILING MOUNT)

SELECTION CHART

	101/102	103/104	141/142	148	236/237
Configuration	Transceiver	Transceiver	Transceiver	Dual Transceivers	Transmitter
Maximum Coverage	25' x 30'	25' x 30'	25' x 30'	25' x 50'	Variable *
Power Requirement	16.5VAC	12VDC	16.5VAC	16.5VAC	Powered By Transceiver
Transformer	Supplied	Not Required	Supplied	Supplied	Not Required
Rechargeable Standby	Built-in	Not Required	Built-in	Built-in	Not Required
Alarm Output	SPDT	SPDT	SPST	SPST	Frequency
Latch/Indicator Circuit	Standard	Standard	Not Available	Not Available	Not Available
Alarm/Walk-Test LED	Red	Red	Red	Red	Yellow
Tamper Protection	Built-in	Built-in	Requires DU-239	Requires DU-239	Requires DU-239
Mounting	Surface	Surface	Surface	Surface	Surface
Enclosure	Plastic	Plastic	Plastic	Plastic	Plastic
Color	Brown (101) White (102)	Brown (103) White (104)	Brown (141) White (142)	White	Brown (236) White (237)
U.L. Listed	Yes	Yes	Yes	Yes	Yes

Information

PERFORMANCE CONSIDERATIONS

The detection units work best when the ultrasonic waves are bouncing off of hard, smooth surfaces. Furniture, carpeting and drapery reduce the coverage because they absorb sound waves. Transceivers and transducers should be aimed at the hard smooth surfaces.

Air turbulence such as drafts, space heaters, air conditioning will affect the performance of transceivers and transducers. Sources of ultrasonic noise such as telephone bells and whistles can disturb the detector. Vibration from loose doors, machinery and passing traffic can effect the ultrasound detector. Ultrasonic systems are affected by humidity and temperature. All of these factors should be considered in planning a system.

SELECTING A SYSTEM FOR AN APPLICATION

The ultrasonic detector is widely used in space protection. A first consideration will be to decide where space protection fits the overall security system. The following questions may be helpful in making a selection.

- How many areas need to be protected?
- Will space protection be the primary or secondary form of protection?
- How large is each area?
- What is the shape of each area?
- Where are the points of entry?
- What objects will obstruct the sound path?
- Is the environment "hard" or "soft"?
- What hazards exist such as air vents, fans, blowers, hanging objects, sources of noise?
- Is remote control required?
- Is individual area alarm memory or remote area annunciation needed?

THE ULTRASONIC SYSTEM

The ultrasonic detection system is composed of:

Information

1. Master control unit which contains tamper switches to protect it from intruders. It has a signal processing circuit for taking signals from the detector and passing it on to the alarm. Most controls have a 12 volt standby battery system. Light emitting diodes are used to show where areas are being intruded. A control unit may control dozens of detectors and have a zone annunciator panel to show exact location of intrusion.

2. Detectors include either individual transducer units or transceivers. These may be multiple units that give the best coverage of the area. Some detectors have built-in tamper protection, rechargeable standby batteries, transformers and LED indicators.

3. Power supply includes both AC and DC. Most systems require 12 to 16 volts. Standby systems are rechargeable DC units that range from lead-acid batteries to nicads.

Assignment

- Ask employer for supply catalogs and other information on ultrasonic systems.
- Study the specifications of various systems.
- Observe the different configurations of systems.
- Study recommendations for use of systems and the conditions under which good performance can be expected.

Job Sheet

CONNECT AN ULTRASONIC DETECTION SYSTEM

EQUIPMENT NEEDED:

  * Transceiver
  * Control unit

- Place and aim tronsceiver at a space to be protected.
- Connect transceiver to control panel.
- Adjust transceiver to environment.
- Walk-in test to see if detector is working.

INSTRUCTIONAL LEARNING SYSTEMS

Self Assessment

1. What is ultrasound?

2. What are the units of frequency measurements?

3. A transceiver is one unit that contains a _________ transducer and a ____________________ transducer.

4. Does a transceiver give better coverage than transducers?

5. A _______________ switch is usually used to protect the control unit.

6. List three things that may cause problems with an ultrasonic system?

7. Signal lights on the control unit are made with ______________________.

8. Standby battery systems for control units are usually ______ volts.

9. Are standby systems rechargeable?

10. Hard, smooth surfaces improve the coverage of ultrasonic detectors. T or F

Self Assessment Answers

1. Ultrasound is sound of a higher frequency than the human ear can hear.
2. Hertz (Hz)
3. Transmitting and receiving transducers
4. No
5. Tamper
6. Air turbulence, ultrasonic noise, vibration
7. LED's
8. 12
9. Yes
10. True

INSTRUCTIONAL LEARNING SYSTEMS

• Post Assessment

1. What is the advantage of using transducers instead of a transceiver?

2. What is the advantage of the transceiver?

3. The change in frequency of sound from moving objects is called the _______________ shift.

4. What type of transducer is used to convert electrical energy to sound energy?

5. A transmitting transducer and a receiving transducer are often packaged into one unit. This unit is a _____________________.

6. What is measured by hertz (Hz)?

7. Where are light emitting diodes (LED's) used in the ultrasonic detection system?

8. What type of standby power supply is used in ultrasonic systems?

9. What types of interior surfaces are best suited to ultrasonic systems?

10. Soft rugs, draperies and pillows are helpful to the ultrasonic system. T or F

Instructor Post Assessment Answers

1. Better coverage
2. Easier to wire
3. Doppler
4. Transmitting
5. Transceiver
6. Frequency of sound
7. Light indicators that show a zone has been intruded or to show that system is armed.
8. Rechargeable (mostly 12 volt)
9. Hard, smooth
10. False

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

12.8

GAS DETECTORS

Goal:

The apprentice will be able to describe gas detectors and their application.

Performance Indicators:

1. Describe a gas sensor.
2. Describe the electrical components of a gas sensor.
3. Describe applications of a gas sensor.

Study Guide

- Read goal and performance indicators to find what is to be learned in package.
- Study the vocabulary list to find new terms to be learned.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check answers.

Vocabulary

- Combustible gasses
- Gas sensor
- Hazardous fumes
- Inverter
- Light-emitting diode (LED)
- NAND gate
- Three core cable
- Variable resistor

Introduction

Gas sensors are used in fire alarm systems to detect combustible gasses of smoke. The gas detector is a very sensitive device and will alarm at small amounts of gas vapor.

The gas sensor is widely used to detect hazardous fumes of escaping gas. Early detection helps prevent explosions and fires caused by gas vapors. Industrial plants use gas detectors to monitor levels of fumes that might injure human health.

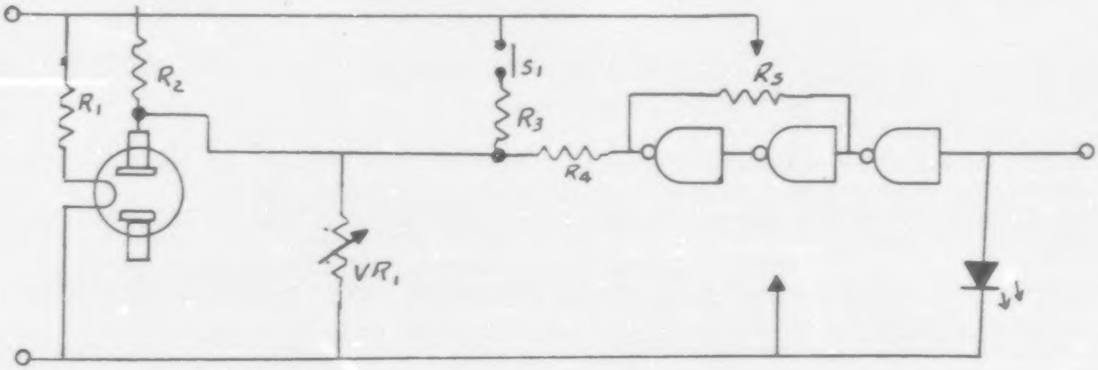
Information

Special gas sensors are used to detect combustible vapors. These sensors detect such vapors as those produced by:

- Kerosene
- Petroleum
- Organic solvent
- Propane
- Natural gas
- Hydrogen
- Carbon monoxide
- Ammonia

The gas sensor is sensitive to unburnt gasses in smoke. It can give warnings of fire and possible explosions. The gas sensor is often used in boats and other settings where gas leakages are a hazard.

A gas sensor is made of two electrodes which are imbedded in resistant materials. A heater element drives off gasses that might become absorbed by the materials over a period of time. When the device senses small quantities of vapors, the electrical resistance of the material is reduced. This resistance loss will cause an alarm.



Information

A gas detector is usually made from a quadruple 2-input NAND integrated circuit. Only three of the gates are used in the sensor circuit. The three NAND gates are all wired as one input gate (inverters). The inverter acts to give a high output when gas is present. A light emitting diode registers the output of the NAND gate.

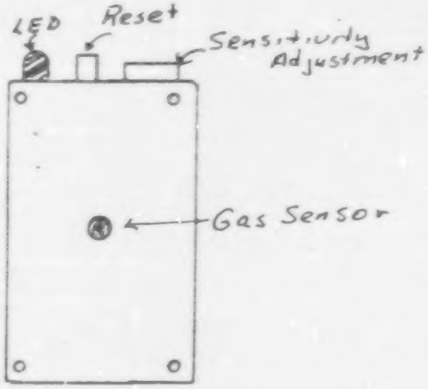
The variable resistor acts to control the sensitivity level of the sensor. A small amount of gas vapor will cause the system to alarm. An installer must set the sensitivity level to allow for exhaust fumes from nearby roads. The sensor is extremely sensitive to gas vapors.

APPLICATION

The gas sensor should be mounted high in the room if it is to serve as a fire detector. If the sensor is used to detect leaking gasses it must be mounted near the floor. The sensor can be connected to the main alarm system with three core cable. The 12 volt supply is carried by two of the cores. The third core carries the circuit output to the NAND gate input of the main alarm system.

The gas detector can be tested by putting a few drops of combustible material on tissue and holding it near the sensor. Oil, gasoline or solvent will work as a test agent. The gasses from a burning match should produce an alarm.

A gas detector will look like this.



Assignment

- Complete the job sheet.
- Complete self assessment.
- Complete post assessment.

Job Sheet

EXAMINE A GAS DETECTOR

- Obtain a gas detector.
- Hook the detector up to a 12 volt power supply according to manufacturers instruction.
- Adjust the sensitivity of the detector to where you think it should be.
- Test detector with a burning match, alcohol, oil and other combustible substance.
- Reset detector between tests.
- Continue adjustment of sensitivity until sensor alarms with very small amounts of fumes.

Self Assessment

1. List two ways in which gas sensors are used

2. The sensor is sensitive to ______________ gasses in smoke.

3. A gas sensor alarms when there is a loss in ____________ due to the sensing of vapors.

4. The IC of a gas detector uses three ______________ logic gates.

5. The ____________ ____________ controls the sensitivity of the gas detectors.

6. A detector should be mounted ________________ when used as a fire alarm.

7. A detector should be mounted ____________ when used to detect leaking gasses.

8. What type of cable is used with gas detectors?

9. The power supply for gas detectors is __________ volt.

10. When NAND gates are wired as one-input gates, they are called _____________.

Self Assessment Answers

1. Fire alarm and detection of leaking gasses.
2. Unburnt
3. Resistance
4. NAND
5. Variable resistor
6. High on the wall
7. Near the floor
8. 3-core cable
9. 12
10. Inverter

Post Assessment

1. Which logic gates are found in the integrated circuit of a gas detector?

2. How many inputs are used with each gate?

3. Where should a gas detector be mounted when used as a fire alarm?

4. Where should a gas detector be mounted to detect leaking gas fumes?

5. What type of cable is used with gas detectors?

6. Gas sensors alarm when there is a loss in ________________.

7. What is the source of light for the indicator?

8. What is the purpose of the variable resistor in a gas detector?

9. How can a sensor be tested to see if it is working?

10. How much power supply is needed to operate gas detectors?

Instructor Post Assessment Answers

1. NAND
2. one
3. High on the wall
4. Near the floor
5. 3-core cable
6. Resistance
7. Light emitting diode (LED)
8. Controls the sensitivity of the detector.
9. Place a few drops of combustible substance on a tissue and hold near sensor.
10. 12 volts

Supplementary References

* Bishop, Owen. Electronic Projects for Home Security. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

12.9

AIRBORNE AND STRUCTURAL PROBLEMS

Goal:

The apprentice will be able to describe problems associated with air conditioning systems and structural materials.

Performance Indicators:

1. Describe effects of air conditioning and heating systems on devices.
2. Describe the effects of structural materials on devices.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list to see the new trade terms to be introduced in this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Vocabulary

- Accoustical energy
- Accoustical properties
- Audible tone
- Microwave energy
- Thermal change

Introduction

The performance of detection devices are often affected by the environment in which the detector is placed. Some of the motion detection devices are extremely sensitive to such things as air currents, heat sources and the walls of the building itself.

Air conditioning and heating systems affect some devices. The materials used in the building influence other types of detectors.

This package will point out the effects of air conditioning and heating systems and structural materials on the performance of detection devices. With such understanding, the installer can avoid many problems in setting up a system.

Information

An installer must consider the effects of air conditioning systems upon some types of detectors. Other types of devices are influenced by the materials used in the structure. These factors become very important with devices used in space and volumetric applications.

Air Conditioning and Heating Systems

Moving air greatly affects the performance of ultrasonic devices. Forced air from heating and air conditioning ducts and drafts from windows distort the energy pattern. Ultrasonic uses air as a medium of transmission. This makes it extremely sensitive to air movements.

The movement of fan blades can false alarm microwave detectors. If the air conditioning system causes the walls to vibrate, this motion will also affect microwave.

Sonic motion detectors are less sensitive to air currents than ultrasonic devices. However, the sonic detector does use air as a medium for its accoustical energy. Air conditioning could be a problem.

Passive infrared devices operate on detection of thermal change. Detectors must be located away from heat sources such as radiators, hot pipes, heaters, etc. These objects can cause false alarms.

Structural Materials

The microwave system has the ability to penetrate walls and detect movements outside of the area being protected. In other words, it may alarm at an automobile on a nearby street. Heavy walls of brick, concrete or cinder block will contain microwave energy much better than glass or wood walls. Detectors should never be pointed directly at an exterior wall.

Glass windows and doors that tend to vibrate or rattle in the wind can affect ultrasonic motion detectors. These same vibrations may affect operable opening switches that are attached to them as sensors.

Metal walls and partitions can be a problem for microwave units. Any metal object will reflect microwave energy and tend to cause false alarms.

Infrared motion detectors should never be directed toward glass covered openings. Sunlight may cause a false alarm by changing the thermal pattern.

Information

The contruction of walls have a definite effect on sonic devices. Sonic detectors operate with an acoustical energy pattern. The materials used in construction of a building affects the acoustical properties of the room. The audible tone of a sonic detector will carry according to the acoustics of the building.

Assignment

- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

ASSESS A ROOM FOR POTENTIAL PROBLEMS

- Select a large room at your place of work.
- Sketch the room showing doors, windows, airconditioning and heating outlets.
- Examine the walls. What are the walls and ceiling made from?
- Assess the following devices as to their appropriateness for protection of that room:

DEVICE	YES	NO	REASON
Microwave			
Passive Infrared			
Sonic			
Ultrasonic			

Self Assessment

1. Which device is most sensitive to moving air masses?

2. Which device is most sensitive to heat sources?

3. Which device is most affected by the construction of walls?

4. Which device is affected by the reflection of their energy pattern off metal objects?

5. Which device is affected by sunlight changing its thermal pattern?

Self Assessment Answers

1. Ultrasonic
2. Infrared
3. Microwave
4. Microwave
5. Infrared

•Post Assessment

How are the following devices affected by air conditioning and heating systems?

1. Ultrasonic

2. Microwave

3. Passive infrared

What influence does the structural properties of a building have on the following devices?

4. Microwave

5. Passive infrared

Instructor Post Assessment Answers

1. Moving air masses will trigger alarm. Air conditioners are big problem.

2. Fan blades rotating will affect microwave. Vibrations from air conditioner.

3. Heat sources such as radiators, heaters and lights change thermal value and cause alarm.

4. Microwave tends to pass through walls and pick up motion outside the building. It will pass through wood and glass easier than concrete or brick walls.

5. Infrared should never be directed toward glass where sunlight will stream in. This could affect the thermal value enough to false alarm.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Application. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

12.10

AUDIO DETECTION SYSTEMS

Goal:

The apprentice will be able to describe an audio detection system.

Performance Indicators:

1. Describe parts of an audio detection system.
2. Describe sound level threshold.
3. Describe adjustments to reduce false alarms from outside noise.
4. Describe monitoring of auido detectors.
5. Describe relationship of audio detection and the skill level of the intruder.

Study Guide

- Read goal and performance indicators to find what you are supposed to learn from this package.
- Read the vocabulary page to find the new terms that will be introduced in package.
- Read introduction and information sheets.
- Complete self assessment and check answers with answer sheet.
- Complete post assessment and ask instructor to score answers.

Vocabulary

- Adjustable pulse count circuit
- Band pass filter
- Cancellation microphones
- Low skill intruder

Introduction

Audio detectors listen for noises made by intruders. They differ from infrared detectors that respond from the thermal energy of the intruder. Audio detectors can be classified as motion detectors because they respond to movements that cause a noise.

Microphones are placed at key locations in the protection area. The microphones pick up sounds in the audio range and send them to a signal processor. If the sounds are greater than the normal sounds, an alarm is triggered.

Audio detectors are often used in schools because the existing public address system can be used as part of the intrusion detection system. The system is an economical one if existing equipment can be used.

The use of audio detection is limited to detect low skill intruders such as vandals. Intruders with greater skill do not make enough noise to set off an audio detector. For this reason, it should be combined with other types of detectors.

Information

An audio detection system consists of:

- Microphones to pick up sound at audio frequency.
- Signal processor in the control unit.

An audio detection system requires that the signal processor be adjusted to the sound level threshold of the background sounds. If the threshold is too high above normal sounds, it may not detect the intruder. A threshold that is too low will be likely to false alarm. False alarms can be reduced by the use of an adjustable pulse count circuit and cancellation microphones. The adjustable pulse count controls the alarm. Only after a series of sounds will the alarm go off. This tends to reduce false alarms from outside noise and allows the system to be set at a lower threshold. Cancellation microphones are set up outside the protection area. They pick up the outside noises, and cancel the same noises picked up by microphones in the protected area. Cancellation takes place in the signal processor. Noises such as vehicles, trains and planes can be cancelled in the system.

FREQUENCY RANGES OF DETECTORS

Audio detectors are made to detect different frequencies of sound. Some detect high frequency sounds such as cutting through metal. Some detectors use band pass filters that allow only high frequency signals to pass to the signal processor. The high frequency detector would not be a good one if the intruder was breaking through sheet rock or other soft building materials.

MONITORING AUDIO DETECTORS

The monitor of an audio system can listen to the sounds that are causing the alarm. If the sounds can be identified, a response can be planned. Many times the monitor can determine if it was a false alarm. This feature is an advantage if the monitor knows the normal sounds of the protected area. The system can be used to verify that intrusions have occurred.

SKILL LEVEL OF INTRUDERS

Audio detectors are not good detectors if the intruder is one of great skill. Experienced intruders do not make a lot of noise. Low skill intruders such as those committing vandalism are noisy and will set off the alarm. The nature of the threat will help determine if audio detectors should be part of the system. Although the audio detector might be a good choice for protecting the boys locker room, it may not be a good choice for a jewelry store. Audio detectors should be used with other types of detectors. The best use of audio detectors is to assess the cause of alarms.

Assignment

- Complete self assessment and check answers with answer sheet.
- Complete post assessment and have instructors score answers.

Self Assessment

1. List two techniques for reducing false alarms in an audio detection system.

2. What is sound level threshold?

3. Band pass filters permit only ______________ frequency sounds to pass to the signal processor.

4. The audio detector is best suited to intruders with ______________ (high, low) skill level.

5. The two main parts of an audio detector system are ______________ and a ______________________.

Self Assessment Answers

1. Adjustable pulse count circuit and cancellation microphones.

2. The noise level at which an alarm will be set off. It is adjusted according to normal noise levels of the area.

3. High

4. Low

5. Microphones and signal processor.

•Post Assessment

1. Describe sound level threshold.

2. List one setting where audio detectors might be used.

3. Describe audio detection as related to skill levels of intruders.

4. What is the purpose of cancellation microphones?

5. How does an adjustable pulse count circuit reduce the number of false alarms?

Instructor Post Assessment Answers

1. The sound level threshold is the noise level at which the alarm is set off. Adjustments are made to the background noise level to prevent false alarming of system.

2. Schools use audio detectors because they can be operated on existing public address systems.

3. Audio detection operates on noise levels of intruders. High skill level intruders do not make a lot of noise. The system is useful in detection of low skill level intruders such as vandals. Low skill level intruders are noisy during intrusions.

4. Reduces false alarms. Cancellation microphones cancel out noises from outside the protected area.

5. Adjustable pulse count circuits prevent alarming on one loud noise. After a series of noises the alarm will go off.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981. Pages 181-185.

INSTRUCTIONAL LEARNING SYSTEMS

13.1

TRADE TERMS

Goal:

The apprentice will be able to use trade terms of the security alarm field.

Performance Indicators:

1. Use trade terms in communicating with others.
2. Understand trade terms when given as part of a work assignment.

Study Guide

- Read the trade terms and definitions in the information sheets. Check off those that are already known to you.
- Learn 10 new words each week and check those off the list. Continue until you know all of the trade terms found in this package.
- Add new trade terms that are not found in this package. As you hear or read a new term, add it to the list.
- Keep this package as a handy reference for learning new terms. When you become an experienced installer, the list of terms will no longer be needed. Then it will only be a matter of keeping up with new terms of your trade.

Vocabulary

- The trade terms found in the information sheets make up a vocabulary list.

Introduction

Every occupation uses trade terms to communicate with others in their field of work. The medical profession uses trade terms that are not well understood by the average person. Lawyers use legal terms. Farmers have their special language for talking among themselves.

The security alarm field has trade terms that describe their work, equipment and procedures. In order to communicate with others in their field, apprentices must know the common trade terms.

Information

The common trade terms for the security alarm field are listed and defined.

Access Control

The control of pedestrian and vehicular traffic through entraces and exits of a protected area or premisses.

Access Mode

The operation of an alarm system such that no alarm signal is given when the protected area is entered; however, a signal may be given if the annunciator or control unit is tampered with or opened.

Access/Secure Control Unit

An electronic unit which serves as the local control unit for sensors and allows deactivation of selected sensors.

Accumulator

A circuit which accumulates a sum. For example, in an audio alarm control unit, the accumulator sums the aplitudes of a series of pulses, which are larger than some threshold level, subtracts from the sum at a predetermined rate to account for random background pulses, and initiates an alarm signal when the sum exceeds some predetermined level.

Actuating Device or Actuator

A manual or automatic switch or sensor such as a holdup button, magnetic switch, or thermostat which causes a system to transmit an alarm signal when manually activated or when the device senses an intruder or other unwanted condition.

Alarm

An alarm device, alarm condition, or an alarm signal.

Alarm Circuit

An electrical circuit of an alarm system which produces or transmits an alarm signal.

Information

Alarm Condition

A dangerous or unwanted condition sensed by an alarm device such as an intrusion, or fire or holdup.

Alarm Device

A device designed to sense some predetermined dangerous or unwanted condition and produce a signal.

Alarm Discrimination

The ability of an alarm device to distinguish between those stimuli caused by an intrusion and those which are a part of the environment.

Alarm Line

A wired electrical circuit used for the transmission of alarm signals from the protected premises to a monitoring station.

Annunciator

An alarm monitoring device which consists of a number of visible signals such as "flags" or lamps indicating the status of the detectors in an alarm system or systems.

Answering Service

A business which contracts with subscribers to answer incoming telephone calls after a specified delay or when scheduled to do so.

Area Protection

Protection of the inner space or volume of a secured area by means of a volumetric sensor.

Area Sensor

A sensor with a detection zone which approximates an area, such as a wall surface or the exterior of a safe.

Information

Audible Alarm Device

(1) A noisemaking device such as a siren, bell or horn used as part of a local alarm system to indicate an alarm condition. (2) A bell, buzzer, horn or other noisemaking device used as part of an annunciator to indicate a change in the status or operating mode of an alarm system.

Audio Detection System

An alarm system which detects the sound or vibrations caused by attempted forceful entry into a protected structure. The system consists of microphones and a control unit containing an amplifier, accumulator, and a power supply.

Audio Frequency (Sonic)

Sound frequencies within the range of human hearing, approximately from 16 to 20,000 Hz.

Audio Monitor

An arrangement of amplifiers and speakers designed to monitor the sounds transmitted by microphones located in the protected area.

Audio Sensor

A sensor which responds to sound; a microphone.

Beam Divergence

In a photoelectric alarm system, the angular spread of the light beam.

Break Alarm

(1) An alarm condition signaled by the opening or breaking of an electrical circuit.
(2) The signal produced by a break alarm condition.

Bug

(1) To plant a microphone or other audio sensor; to tap a communication line for the purpose of surreptitious listening or audio monitoring; loosely, to install a sensor in a specified location. (2) The microphone or other sensor used for listening.

Information

Building Security Alarm System

The system of protective signlaing devices installed at a premises.

Burglar Alarm (B.A.) Pad

A supporting frame laced with fine wire or a fragile panel laced with foil or fine wire and installed so as to cover an exterior opening in a building, such as a vent, door or skylight. Entrance through the opening breaks the wire or foil and initiates an alarm signal.

Capacitance Alarm System

An alarm system in which a protected object is electrically connected as a capacitance sensor so that its capacitance forms part of a tuned circuit. The approach of an intruder causes sufficient change in capacitance to upset the balance of the system and initiate an alarm signal.

Central Station

A control center to which alarm and supervisory signaling devices in a subscriber's premises are connected, where circuits are supervised, and where personnel are maintained continuously to record and investigate alarm or trouble signals.

Circuit

A combination of electrical devices providing one or more closed electrical paths.

Circumvention

The defeat of an alarm system by the avoidance of its detection devices, such as by jumping over a pressure sensitive mat, by entering through a hole cut in an unprotected wall rather than through a protected door, or by keeping outside the range of an ultrasonic motion sensor. Circumvention contrasts with SPOOFING.

Closed Circuit

A circuit in which there is a current through each of the system sensors when not in the alarm condition.

Information

Clutch Head Screw

A mounting screw with a uniquely designed head for which the installation and removal tool is not commonly available. They are used to install alarm system components so that removal is inhibited.

Coded-Alarm System

An alarm system in which the source of each signal is identifiable.

Coded Cable

A multiconductor cable in which the insulation on each conductor is distinguishable from all others by color or design. This assists in identification of the point of origin or final destination of a wire.

Coded Transmitter

A device for transmitting a coded signal when manually or automatically operated by an actuating device. The actuator may be housed with the transmitter or a number of actuators may operate a common transmitter.

Coding Siren

A siren which has an auxiliary mechanism to interrupt the flow of air through its principal mechanism, enabling it to produce a controllable series of sharp blasts.

Conductor

A material which can conduct electric current, such as the metal forming a wire or cable.

Constant Ringing Drop (CRD)

A relay which when activated even momentarily will remain in an alarm condition until reset. A key is often required to reset the relay and turn off the alarm.

Contact

(1) Each of the pair of metallic parts of a switch or relay which by touching or being separated make or break the electrical current path. (2) A switch-type sensor.

Information

Contact Device

A device which when actuated opens or closes a set of electrical contacts; a switch or relay.

Contact Microphone

A microphone designed for attachment directly to a surface of a protected area or object; usually used to detect surface vibrations.

Contactless Vibrating Bell

A vibrating bell without circuit-interrupting contacts whose continuous operation depends upon application of an alternating current.

Control Cabinet or Unit

A device, usually electronic, which responds to an alarm signal by generating a suitable response such as sounding an audible alarm device, turning on a signal light, initiating an automatic telephone dialer, or a combination of responses.

Cross Alarm

(1) An alarm condition signaled by crossing or shorting an electrical circuit.
(2) The signal produced due to a cross alarm condition.

Crossover

An insulated electrical path used to connect foil across window dividers, such as those found on multiple pane windows, to prevent grounding and to make a more durable connection.

Dark Current

The current output of a photoelectric receiver when no light is entering the receiver.

Defeat

The frustration, counteraction, or making ineffective of an alarm device so that it fails to signal an alarm when a protected area is entered. Defeat includes both circumvention and spoofing.

Information

Detector

(1) A sensor such as those used to detect intrusion, equipment malfunctions or failure, rate of temperature rise, smoke or fire. (2) A demondulator, a device for recovering the modulating function or signal from a modulated wave.

Door Cord

A short, insulated cable with an attaching block and terminals at each end used to conduct current to a device, such as foil, mounted on the movable portion of a door or window.

Door Trip Switch

A mechanical switch mounted so that movement of the door will operate the switch.

Doppler Effect (Shift)

The apparent change in frequency of sound or radio waves when reflected from or originating from a moving object. Utilized in some types of motion sensors.

Double-Circuit System

An alarm circuit in which both the high and low sides of the circuit are routed through each sensor.

Double Drop

An alarm signaling method often used in central station alarm systems in which the line is first opened to produce a break alarm and then shorted to produce a cross alarm.

Duress Alarm

(1) A device which produces either a silent alarm or local alarm under a condition of stress such as holdup, fire, illness, or other panic or emergency. The device is usually surreptitious or covert and the alarm silent when used as a holdup alarm.

Fail Safe

A feature of a system or device which initiates an alarm or trouble signal when the system or device either malfunctions or loses power.

Information

False Alarm

(1) An alarm signal for which an investigation discloses no evidence of an alarm condition. (2) Any alarm signal which is not caused by that condition which the alarm system was designed to detect.

False Alarm Rate, Monthly

The number of false alarms per month divided by the number of alarm installations, usually expressed as a percentage.

False Alarm Ratio

The ratio of false alarms to total alarms, may be expressed as a percentage.

Field

The space or area under the influence of a force such as electricity or magnetism produced by an electrically charged object, current, or a magnet.

Floor Mat

A pressure sensor mat wired to make or break contact when stepped upon.

Floor Trap

A device which initiates an alarm signal when an intruder breaks or moves a wire installed across a floor space.

Foil

Thin metallic strips which are cemented to the glass in a window or door, usually near the edges, and connected to a closed electrical circuit. If the glass is broken so as to break the foil, the circuit opens, initiating an alarm signal. Also called tape. A window or door to which foil has been applied is said to be taped or foiled.

Foil Connector

An electrical terminal block used on the edge of a window to join interconnecting wire to window foil.

Information

Foot Rail

A duress alarm, often used at cashiers' windows, in which a foot is placed under the rail, lifting it, to initiate an alarm signal.

Grid

(1) An arrangement of electrically conducting wire, screen, or tubing placed in front of doors or windows or both which is used as part of a capacitance sensor. (2) A lattice of wooden dowels or slats concealing fine wires in a closed alarm circuit which initiates an alarm signal when forcing or cutting the lattice breaks the wires. Used over accessible openings. Sometimes called a protective screen.

Heat Detector or Sensor

A sensor which responds to either a temperature above a selected value or a temperature increase which is at a rate of increase greater than a preselected rate.

Holdup

Any action to obtain or attempt to obtain valuables by threat or force. A robbery.

Holdup Alarm System Automatic

A duress alarm system in which the signal transmission is initiated solely by the action of the intruder.

Holdup Alarm System, Manual

A duress alarm system in which the signal transmission is initiated by the direct action of the person attacked or of an observer of the attack.

Holdup Alarm System, Semiautomatic

A duress alarm system in which the signal transmission is initiated by the indirect or covert action of the person attacked or of an observer of the attack.

Holdup Button

A mechanical switch used to initiate a duress alarm signal; usually constructed to minimize accidental activation.

Information

Hood Contact

A switch which is used for the supervision of a closed safe or vault door. Usually installed on the outside surface of the protected door.

Infrared (IR) Motion Detector or Sensor

A sensor which detects changes in the infrared light radiating from parts of the protected area. Presence of an intruder in the area changes the infrared light intensity from his location.

Interior Perimeter Protection

A line of protection along the boundary of a protected area including all points through which entry can be effected.

Intrusion

Unauthorized entry onto the property of another.

Intrusion Alarm System

An alarm system for signaling the entry or attempted entry of a person into the area protected.

Jack

An electrical connector which is used for frequent connect and disconnect operations; for example, to connect an alarm circuit at an overhead door.

Lacing

A network of fine wire surrounding or covering an area to be protected, such as a safe, vault, or light door panel, and connected into a closed circuit alarm system.

Line Amplifier

An audio amplifier which is used to provide preamplification of an audio alarm signal before transmission of the signal over an alarm line. Use of an amplifier extends the range of signal transmission.

Information

Line Sensor or Detector

A sensor with a detection zone which approximates a line or series of lines, such as a photoelectric sensor which senses a direct or reflected light beam.

Line Supervision

Electronic protection of an alarm line accomplished by sending a continuous or coded signal through the circuit.

Local Alarm

An alarm which when activated makes a loud noise at or near the protected area or floods the site with light or both.

Local Alarm System

An alarm system which when activated produces an audible or visible signal in the immediate vicinity of the protected premises or object.

Loop

A series electrical circuit consisting of several elements, usually switches, so connected that the current path is through each element in succession.

Magnetic Contact or Switch

A switch which consists of two separate units; a magnetic actuated switch, and a magnet. The switch is usually mounted in a fixed position (door jamb or window frame) opposing the magnet, which is fastened to a hinged or sliding door, window, etc. When the movable section is opened, the magnet moves with it, actuating the switch.

McCulloh Circuit or Loop

A supervised single wire loop connecting a number of coded transmitters located in different protected areas to a central station receiver.

Mechanical Switch

A switch in which the contacts are opened and closed by means of a depressable

Information

plunger or button.

Mercury Switch

A switch operated by tilting which causes an enclosed pool of mercury to move, making physical and electrical contact with conductors.

Microwave Alarm System

An alarm system which employs radio frequency motion detectors.

Microwave Frequency

Radio frequencies in the range of approximately 0.3 to 300 GHz.

Monitor Cabinet

An enclosure which houses the annunciator and associated equipment.

Monitoring Station

The central station or other remote area at which guards, police, or commercial service personnel observe annunciators and registers reporting on the condition of remote alarm systems.

Motion Detector or Sensor

A sensor which responds to the motion of an intruder.

Multiplexing

A technique for the concurrent transmission of two or more signals in either or both directions, over the same wire, carrier or other communication channel.

Multiplexing, Frequency Division (FDM)

The multiplexing technique which assigns to each signal a specific set of frequencies (called a channel) within the larger block of frequencies available on the main trasnmission path in much the same way that many radio stations broadcast at the same time but can be separately received.

Information

Multiplexing, Time Division (TDM)

The multiplexing technique which provides for the independent transmission of several pieces of information on a time-sharing basis by sampling, at frequent intervals, the data to be transmitted.

Nicad

Contraction of nickel cadmium. A high performance, long-lasting rechargeable battery which may be used for an emergency power supply of an alarm system.

Nonretractable (one-way) Screw

A screw with a head designed to permit installation with an ordinary flat bit screwdriver but which resists removal. They are used to install alarm system components so that removal is inhibited.

Normally Closed (NC) Switch

A switch in which the contacts are closed when no external forces act upon the switch.

Normally Open (NO) Switch

A switch in which the contacts are open (separated) when no external forces act upon the switch.

Open Circuit

A circuit in which there is no current until the closing of a switch causes a current which activates an alarm signal.

Open Circuit System

A system which uses open circuit sensors connected in parallel. When a sensor is activated, the circuit is closed, permitting a current which activates an alarm signal.

Passive Ultrasonic Alarm System

A vibration detection system or audio detection system which operates at ultrasonic frequencies.

Information

Perimeter Alarm System

An alarm system which consists of the protection of all doors, walls, windows, and other entry points to the protected area by means of contact devices, switches, foil, etc.

Permanent Circuit

An alarm circuit which is capable of trasnmitting an alarm signal whether the alarm control is in access mode or secure mode.

Photoelectric Alarm System

An alarm system which employs light beams and photoelectric sensors to provide a line of protection.

Photoelectric Detector or Sensor

A device which detects a visible or invisible beam of light and responds to its complete or nearly complete interruption.

Police Connection

The direct link by which an alarm system is connected to an annunciator installed in a police station. Examples of a police connection are an alarm line, a telephone dialer and switching network, or a radio communications channel.

Pressure Alarm System

An alarm system which protects a vault or other enclosed space by maintaining and monitoring a predetermined air pressure differential between the inside and outside of the space.

Printing Recorder

An electromechanical device used at a monitoring station which accepts coded signals from alarm lines and converts them to a printed record of the signal received.

Proprietary Alarm System

An alarm system which is similar to a central station system except that the annunciator

Information

is located in a constantly manned guard room maintained by the owner for his own internal security operations. The guards monitor the system and respond to all alarm signals or alert local law enforcement agencies or both.

Protected Area

The area monitored by a security system such as an alarm system, guards, or enclosed by suitable barriers.

Protection Device

(1) A sensor such as a grid, foil, contact, or photoelectric sensor connected into an intrusion alarm system. (2) A barrier which inhibits intrusion such as a grille, lock, fence or wall.

Protective Signaling

The initiation, transmission, and reception of signals involved in the detection and prevention of property loss due to fire, burglary, or other destructive conditions. Also the electronic supervision of persons and equipment concerned with this detection and prevention.

Radar Alarm System

An alarm system which employs radio frequency motion detectors.

Radio Frequency (RF) Motion Detector

A sensor which detects the motion of an intruder through the use of radio frequency generating and receiving equipment. The device operates by filling a space with a pattern of radio waves; the modulation of these waves by a moving object is detected and initiates an alarm signal. These devices are often called microwave motion detectors. They are also sometimes called radar units.

Register (Signal Recorder)

An electromechanical device which marks a paper tape in response to signal impulses received from transmitting circuits. A register may be driven by a prewound spring mechanism, an electric motor, or a combination of these.

Register, Inking

A register which marks the tape with ink.

Information

Register, Punch

A register which marks the tape by cutting holes in it.

Register, Slashing

A register which marks the tape by cutting V-shaped slashes in it.

Remote Alarm

An alarm signal which is transmitted to a remote monitoring station. A local alarm may also be activated.

Remote Station Alarm System

A central station alarm system or a police station unit.

Reset

To restore a device to its original (normal) condition after an alarm or trouble signal.

Retard Transmitter

A coded transmitter in which a delay period is introduced between the time of activation and the time of signal transmission.

Secure Mode

The method of operation of an alarm system such that all sensors and control units are ready to respond to an intrusion.

Sensor

A device which is designed to produce a signal or alarm in response to an event or stimulus within its detection zone.

Shunt or Shunt Switch

(1) A deliberate shorting-out of a portion of an electric circuit. (2) A key-operated switch which removes some portion of the protective system from the circuit,

Information

allowing entry into a protected area without initiating an alarm signal. A type of authorized access switch.

Silent Alarm

A remote alarm without an obvious local indication that an alarm has been transmitted.

Silent Alarm System

An alarm system which signals a remote station by means of a silent alarm.

Single Circuit System

An alarm circuit which routes only one side of the circuit through each sensor.

Smoke Detector

A device which detects visible or invisible products of combustion.

Solid State

An adjective used to describe a device such as a semiconductor transistor or diode; a circuit or system which does not rely on vacuum or gas-filled tubes to control or modify voltages and currents.

Sonic Motion Detector

A motion sensor which uses audible sound waves to detect the motion of an intruder or any other disturbance of a sound pattern generated within the protected area.

Spoofing

The defeat of an alarm system by "tricking" or "fooling" its detection devices such as by short circuiting part or all of a series circuit, cutting wires in a parallel circuit, reducing the sensitivity of a sensor, or entering false signals into the system.

Spot (Point) Protection

Protection of objects such as safes, art objects, or anything of value which could be damaged or removed from the protected premises.

Information

Spring Contact

A device employing a current-carrying cantilever spring which monitors the position of a door or window.

Subscriber's Equipment

That portion of an alarm system installed in the protected premises.

Subscriber's Unit

An authorized access switch.

Supervisory Alarm System

An alarm system which monitors conditions or persons or both and signals any deviation from an established norm or schedule.

Supervisory Circuit

An electrical circuit or radio path which sends information on the status of a sensor or guard patrol to an annunciator.

Surveillance

(1) Control of premises for security purposes through alarm systems, closed circuit television (CCTV) or other monitoring methods. (2) Supervision or inspection of industrial processes by monitoring those conditions which could cause damage if not corrected.

Switch

A device which makes, breaks or changes the direction of the current of an electrical circuit.

Tamper Device

(1) Any device, usually a switch which is used to detect an attempt to gain access to the alarm circuitry, such as by removing a switch cover. (2) A monitor circuit to detect any attempt to modify the alarm circuitry, such as cutting a wire.

Information

Tamper Switch

A switch which is installed in such a way as to detect attempts to remove the enclosure of some alarm components such as control box doors, switch covers, junction box covers, or bell housings. The alarm component is then often described as being "tampered."

Telephone Dialer, Automatic

A device which, when activated, automatically dials one or more pre-programmed telephone numbers (e.g., police, fire department) and relays a recorded voice or coded message giving the location and nature of the alarm.

Telephone Dialer, Digital

An automatic telephone dialer which sends its message as a digital code.

Terminal Resistor

A resistor used as a terminating device.

Terminating Device

A device which is used to terminate an electrically supervised circuit.

Timing Table

That portion of the central station equipment at which means are provided for the checking of incoming signals from McCulloh circuits.

Toggle Switch

A simple on/off switch, operated by a lever. Used for a master control switch, cut-off switch, etc., in a protected place.

Trap

A surreptitious switch used to detect the unauthorized opening of a protected device, cabinet, or access opening.

Information

Trickle Charge

A continuous direct current, usually very low, which is applied to a battery to maintain it at peak charge or to recharge it after it has been partially or completely discharged.

U.L. Certificated

For certain types of products which have met U.L. requirements, for which it is impractical to apply the U.L. Listing Mark or Classification Marking to the individual product, a certificate is provided which the manufacturer may use to identify quantities of material for specific job sites or to identify field installed systems.

U.L. Classified

A service of the Underwriters' Laboratories to evaluate and classify products with respect to specific hazards, limitations, or conditions of performance.

U.L. Listed

Signifies that production samples of the product have been found to comply with established Underwriters' Laboratories requirements and that the manufacturer is authorized to use the Laboratories' Listing Marks on the listed products which comply with the requirements, contingent upon the follow-up services as a check of compliance.

Ultrasonic

Pertaining to a sound wave having a frequency above that of audible sound (approximately 20,000 Hz). Ultrasonic sound waves are used in the ultrasonic motion detection system to provide surreptitious space protection.

Ultrasonic Frequency

Sound frequencies which are above the range of human hearing; approximately 20,000 Hz and higher.

Ultrasonic Motion Detector

A sensor which detects the motion of an intruder through the use of ultrasonic frequency generating and receiving equipment.

Information

Underdome Bell

A bell most of whose mechanism is concealed by its gong.

Underwriter's Laboratories, Inc. (U.L.)

Independent research and testing laboratories which test and list various items meeting good practice and safety standards.

Vibrating Bell

A bell whose mechanism is designed to strike repeatedly and for as long as it is activated.

Vibration Detection System

An alarm system which employs one or more contact microphones or contact vibration sensors which are fastened to the inner surfaces of the area or object being protected to detect excessive levels of vibration.

Vibration Detector or Sensor

A sensor which responds to vibrations of the surface on which it is mounted. There are two basic types of vibration sensors: the contact vibration sensor, and the contact microphone. The contact vibration sensor has a normally closed switch which will momentarily open when subjected to a vibration with large amplitude. The vibration sensor sensitivity (i.e., the vibration amplitude required to open the vibration sensor switch) is adjustable to allow for the different levels of normal vibration, to which the sensor should not respond, at different locations.

Visual Signal Device

General term for a pilot light, annunciator or other device which provides a visual indication of the condition being supervised.

Volumetric Detector or Sensor

A sensor with a detection zone which extends over a volume such as an entire room, part of a room, or a passageway. Ultrasonic motion sensors and sonic motion detectors are examples of volumetric sensors.

Information

Watchman's Reporting System

A supervisory alarm system arranged for the transmission of a patrolling watchman's regularly recurrent report signals from stations along his patrol route to a central supervisory agency.

Zoned Circuit

A circuit which provides continual protection for parts or zones of the protected area while normally used doors and windows or zones may be released for access.

Zones

Smaller subdivisions into which large areas-are divided to permit selective access to some zones while maintaining other zones secure and to permit pinpointing the specific location from which an alarm signal is transmitted.

Assignment

- Complete self assessment and check your answers.
- Complete post assessment and have instructor check your answers.
- Use trade terms in conversation to make them part of your working vocabulary.

Self Assessment

Define the following terms in your own words:

1. Alarm Device
2. Audio Detection System
3. Audio Sensor
4. Central Station
5. Contact Device
6. Foot Rail
7. Interior Perimeter Protection
8. Mercury Switch
9. Photoelectric Sensor
10. Underwriter Laboratories

Self Assessment Answers

1. A device that is designed to sense trouble and produce a signal.
2. Detects sound or vibrations caused by forced entry.
3. A sensor that responds to sound-microphone.
4. A control center for receiving and monitoring signals and investigating alarms.
5. A device which is actuated by opening or closing a set of electrical contacts.
6. A duress alarm at cashiers' windows which is activated by stepping on it.
7. A line of protection around protected area including all points of entry.
8. A switch operated by a mercury pool which moves to cover the contacts.
9. A device which detects visible or invisible light beams.
10. Research laboratories that test products that meet good practice and safety standards.

Post Assessment

Describe in your own words the meaning of the following trade terms:

1. Beam Divergence

2. Capacitance Alarm System

3. Closed Circuit

4. Line Sensor

5. Magnetic Contact

6. McCulloh Circuit

7. Monitoring Station

8. Normally Closed Switch

9. Passive Ultrasonic Alarm System

10. Radio Frequency Motion Detector

Instructor Post Assessment Answers

1. The angular spread of a photo-electric beam.

2. A system that connects capacitance sensors to protected items.

3. Current flows through circuit when not in alarm condition.

4. Sensors with detection zones that fall in lines or series of lines. Example is photoelectric beam.

5. A switch that is made of two units--a magnetic switch and a magnet. It fastens to sliding windows or doors.

6. A single wire loop that connects coded transmitters to the central station.

7. A station that observe annunciator panels and report on alarms.

8. A switch in which the contacts are closed when no outside forces are acting upon the switch.

9. Vibration or audio detection system that operates at ultrasonic frequencies.

10. Microwave detectors.

Supplementary References

- Security Distributing & Marketing. Past Publications. P.O. Box 272, Culver City, CA 90230.

INSTRUCTIONAL LEARNING SYSTEMS

14.1

INVISIBLE BEAM DETECTORS

Goal:

The apprentice will be able to describe invisible beams and their applications.

Performance Indicators:

1. Describe microwave beam patterns.
2. Describe antenna arrays for microwave detection.
3. Describe application of microwave.
4. Describe infrared beams.
5. Describe infrared applications.

Study Guide

- Read the goals and performance indicators to find what should be learned from package.
- Read vocabulary list to become acquainted with new terms that will be used in the package.
- Study the introduction and information sheets to learn technical content of the package.
- Read the assignment in the supplementary reference.
- Complete the job sheet.
- Complete the self-assessment and check answers with the answer sheet.
- Complete the post assessment and ask your instructor to score the answers.

Vocabulary

- Automatic gain control
- Infrared
- Microwave
- Overlapping
- Paralolic dish antenna array
- Photoelectric cell
- Stacking
- Slotted antenna arrays
- Stripline antenna arrays
- Waveguide horn array

Introduction

Beams are commonly used to detect motion in outdoor areas. These beams are invisible beams of electro-magnetic energy. An intruder is detected when the beam is disturbed.

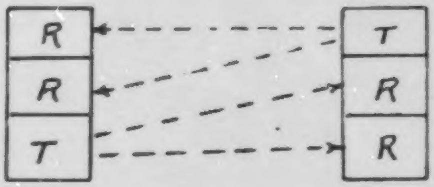
Two types of beams are used in protecting outdoor areas. One operates on microwave frequencies and the other in the infrared frequency. Both are line-of-sight devices that require both transmitters and receivers of the beams.

This package will describe microwave and infrared detection systems and their applications in outdoor security. Other uses of infrared in space and volumetric applications are discussed in another package.

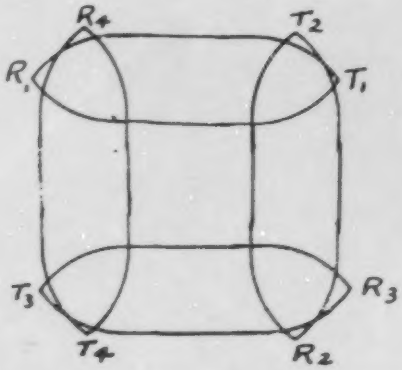
Information

Microwave and infrared both operate with invisible beams. The microwave detector sends out a beam of energy to a receiver. If the receiver detects any reduction or change in the energy pattern, the system will alarm. Infrared sends out a multiple beam pattern of energy. If this energy is disrupted or the beam modulation changes, an alarm signal is generated. Infrared beams are more narrow than microwave beams. For that reason, infrared is more suited to narrow fields of protection such as along fences.

Infrared transmitters and receivers can be stacked together to give any height needed for protection. Stacking can eliminate intrusion by jumping over or crawling under a beam.

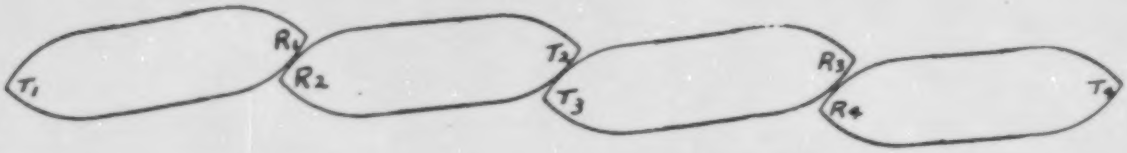


Microwaver detectors send energy from a single point. The beam is broad enough to give good vertical coverage but some areas beneath the transmitter and in corners are unprotected. Added protection can be given to these unprotected areas by overlapping the transmitters and receivers. A top view of an overlap would look like this:



Information

A side view of the overlapping positions would appear as follows:



Note that each transmitter covers the area underneath the one in front of it.

[illegible]h microwave and infrared operate on a line-of-sight from the transmitter to the receiver. Their application requires level ground and an absence of trees and brush. The beams will not pass through hills or other objects that are between the transmitter and receiver. Deep snow and tall grass can interfere with the operation of microwave and infrared. When installing a system, some thought should be given to snow problems and plant growth in the protected area. The system must be placed so that a mower or snow removal equipment can be used to clean the protected area.

Microwave Detectors

Outdoor microwave detectors operate on a frequency band that was allocated by the FCC. The microwave detector uses several types of antenna. These types include parabolic dish arrays, waveguide horns, stripline arrays and slotted arrays. The antenna shape controls the shape of the beam and the distance that the receiver can be placed from the transmitter.

Parabolic Dish Array

This type of antenna has a microwave feed assembly attached to a large reflector. The microwave energy is fed to the reflector which reflects it into a beam pattern. The energy is sent toward the receiver dish and its microwave feed. A crystal oscillator in the feed converts the microwave into electrical signals.

Waveguide Horn

[illegible]e waveguide horn is mounted to a waveguide cavity feed. The size of the waveguide

Information

horn determines the shape of the beam and the distance between transmitter and receiver.

Stripline Antenna Array

The stipline antenna array is a copper conductor etched on a dielectric material. The element is mounted on a reflector and covered by a cylinder shaped dome. This type of antenna sends out a pattern that is more narrow in the horizontal than in the vertical direction. This type of antenna can be used closer to fences than the other types.

Slotted Antenna Array

This antenna has a slotted waveguide feed mounted on a parabolic reflector. The beam is wider than it is high.

Modulation

Microwave energy is modulated by the transmitter and demodulated in the receiver. Signal levels are adjusted by an automatic gain control (AGC) circuit. It is difficult to establish alarm criteria that detects intruders without detecting dogs, cats and birds.

Applications of Microwave

Microwave detectors have ranges up to 1500 feet. The range depends upon the size of the antenna array. The type of antenna array determines the shape of the beam. Antenna arrays are selected according to the beam shape and size of area to be covered. Each detection zone should not exceed 300 feet. Antennas should be overlapped to give protection of blind spots.

Microwave is best suited for level areas that are free of trees and grass. If crawling intruders are to be detected, the ground surface must be level and free of grass.

Microwave is very effective in the detection of intruders that run or walk through the protected area. If low crawling intruders are to be detected, the protection zone must be kept clean.

Infrared Detection

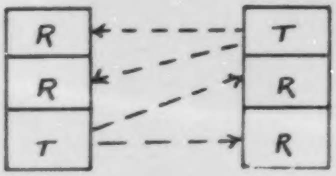
Infrared detectors transmit a multiple-beam pattern of energy. When one beam is

Information

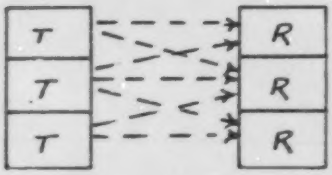
interrupted, the system alarms. The infrared beams pass through a photoelectric cell in the receiver. The photoelectric cell converts the infrared energy into an electrical signal.

Like microwave, the infrared protection area must be free of trees, grass and other obstacles. Weather conditions such as fog and rain will reduce the range of detection.

The infrared detectors can be set up in two ways. Transmitters and receivers can be stacked on alternate sides as shown below:



The units can also be stacked on opposite sides as shown in diagram.



Applications of Infrared

Infrared detectors have operating ranges up to 1000 feet. This maximum range is dependent on clear weather. A range of 300 feet is more realistic.

The infrared detector is used as a detector for perimeter protection of industrial and commercial buildings. They are efficient detectors for intruders that run or walk through the beams.

Alignment of the transmitter and receiver units is critical for good detection.

The space and volumetric applications of photoelectric beams is discussed in another package. Infrared is used as a light beam source in photoelectric detectors.

Assignment

- Read Chapter 6, pages 75-92 in Intrusion Detection Systems: Principles of Operation and Applications. Barnard, Robert L. Butterworth Publishers, Boston, 1981.
- Complete the job sheet.
- Complete self assessment.
- Complete post assessment.

Job Sheet

EXAMINE MICROWAVE AND INFRARED SYSTEMS

- Visit the supply room at your work site or other security alarm businesses.
- Examine microwave antenna systems and read the manufacturers specifications for each system.
  - What is the beam pattern?
  - What is recommended spacing between transmitter and receiver?
  - How does each array function?
- Examine infrared systems for outdoor detection and read manufacturers specifications.
  - Which stacking method is recommended?
  - How are beams aligned?
  - What are the recommended ranges?
  - What are special precautions?
- Study a supply catalog to find types of detectors that are not available at the site. Read the recommendations given in the catalog for each type of detector.

• Self Assessment

1. ______________ detection systems are more suitable for protection of narrow areas, i.e. along fences.

2. Show how transmitters and receivers can be "stacked". Use sketches.

3. Overlapping of protection areas is needed with ___________________ systems.

4. List three types of antenna arrays for microwave detectors.

5. Signal levels in microwave detectors are adjusted by an automatic ______________ control.

6. Microwave detection zones should not exceed ________ feet.

7. Infrared transmits a ______________ beam pattern.

3. Infrared protection zones should not exceed __________ feet.

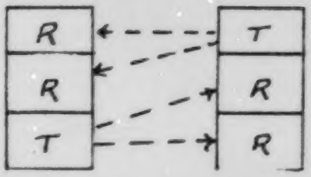
9. Why is level ground needed for microwave and infrared detectors?

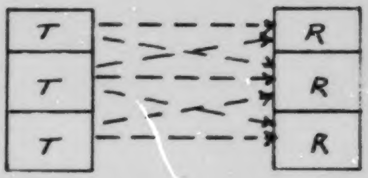
10. What are some common obstacles to good infrared detection?

Self Assessment Answers

1. Infrared

2.





Microwave

4. Parabolic dish, wavehorn guide, stripline, slotted arrays.

5. Gain

6. 300 feet

7. Multiple

8. 300 feet

9. They are both line-of-sight devices.

10. Trees, grass, fog, rain.

Post Assessment

1. Show (by sketching) how microwave detectors can be "overlapped".

2. Show (by sketching) how infrared detectors can be "stacked".

3. List four types of antenna arrays for microwave detectors.

4. Why is level ground important in setting up microwave systems?

5. What is the function of the automatic gain control?

6. Microwave detection ranges should not exceed ________ feet.

7. Why are trees and brush a problem for infrared detectors?

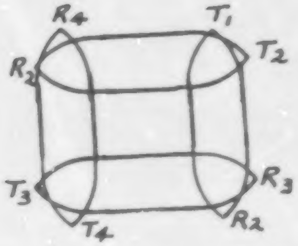
8. How are infrared beams converted into electrical signals?

9. What determines the range of a microwave system?

10. What determines the beam pattern of a microwave system?

Instructor Post Assessment Answers

1.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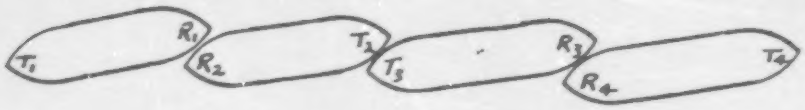
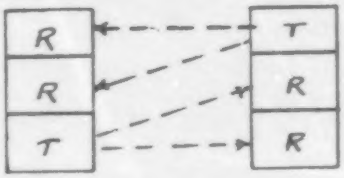
T2
R2
T3
R3
T4
R2


T1
R1
R2
T2
T3
R3
R4
T4

2.



3. Parabolic dish, waveguide horn, stripline, slotted.

4. Microwave is a line of sight device. Crawling intruder detection is dependent on the contour of land.

5. To modulate the microwave energy.

6. 300 feet.

7. Infrared is a line of sight device. Obstacles break this line of sight.

8. Crystal oscillator

9. Antenna shape

10. Antenna shape

Supplementary References

Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston, 1981.

INSTRUCTIONAL LEARNING SYSTEMS

14.2

FENCE DISTURBANCE SENSORS

Goal:

The apprentice will be able to describe fence disturbance sensors and their applications.

Performance Indicators:

1. Describe major types of sensors.
2. Describe how various sensors operate.
3. Describe applications of each type of sensor.

Study Guide

- Read goal and performance indicators to find what you are expected to learn from package.
- Read the vocabulary list to find new terms that will be introduced in package.
- Study introduction and information sheets.
- Complete job sheet.
- Complete self assessment and check answers with answer sheet.
- Complete post assessment and ask instructor to score answer.

Vocabulary

- Band pass filter
- Electret transducer cable
- Electromechanical transducers
- Geophone transducer
- Mechanical inertia switch
- Mercury switch
- Piezoelectric transducer
- Piezoelectric crystal
- Seismic mass
- Shielded cable
- Taut wire switch

Introduction

Fences usually mark the outer perimeters of property and the first line of defense against intrusion. Intruders tend to cut, climb over or crawl under fences. Fence disturbance sensors detect intruders when stress is applied to the wire.

Transducers convert the energy of vibrations into electrical impulses. The vibrations caused by intruders are converted into electrical energy and passed to the signal processor. If the electrical signal meets the alarm criteria, an alarm occurs.

Fence detectors do not work when intruders tunnel underneath or bridge over a fence. If those types of fence intrusion are expected, other detection systems should be considered.

Information

Fence security sensors detect intruders as they climb, cut or crawl through fences. There are many types of sensors used to protect fence. The most common sensors are:

1. Piezoelectric transducers
2. Electromechanical transducers
3. Geophone transducers
4. Electret transducer cables
5. Taut wire switches

Each of the sensors respond to intrusion in different ways:

Piezoelectric -- Responds to amplitude, frequency and duration of electrical signal.
Geophone -- Responds to amplitude, frequency and duration of electrical signal.
Electromechanical transducers -- Responds after several pulses have been recorded on the pulse accummulation circuit.
Electret transducer cables -- Responds to mechanical stresses with electrical signals in the cable.
Taut wire switches -- Responds by closing switch when an intruder pulls on the wire.

PIEZOELECTRIC TRANSDUCERS

A piezoelectric crystal responds to vibrations of the fence breaker and produces an electrical signal. The crystal is made of quartz. When the quartz crystal is exposed to stress, it produces an analog signal.

A band pass filter is used to screen out vibration frequencies that do not fit the desired levels of detection. The band pass filter prevents many false alarms by filtering out low frequency vibrations such as those caused by normal wind. Winds of more than 25 miles per hour will make high frequency vibrations that will cause false alarms. High winds fall into the band pass frequency range.

Transducers can be mounted on the wire or to fence posts. The normal spacing of transducers is about one for each twenty feet of fence. The manufacturers recommendations should be followed. If too many tranducers are used, the signal processor will be confused by background noise. When spaced too far apart, the sensors may not pick up the vibrations of the intruder. Closer spacings improves the signal-to noise ratio at the transducer.

Piezoelectric transducers are wired with shielded cable. Outside electrical interference on the signal is reduced by the use of shielded cable. The transducers are wired in parallel to the signal processor.

GEOPHONE TRANSDUCERS

A geophone transducer converts mechanical vibrations into electrical signals. It consists of a seismic mass, coil of fine wire and a permanent magnet. The magnet is attached to the geophone housing. The seismic mass is suspended in spring balance around the magnet. When the fence is cut or climbed by the intruder, the magnet and housing are displaced by the vibrations. As the magnet moves through the coil of wire an electrical signal is produced at the coil. The signals are amplified and sent to the signal processors. Band pass filters are used to improve the signal and reduce false alarms.

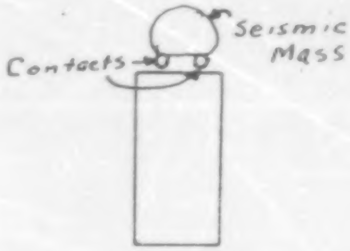
Geophone transducers are attached every 20 feet around the fence. These transducers are mounted into the center of the wire fabric rather than on fence posts.

ELECTROMECHANICAL TRANSDUCERS

Electromechanical transducers are available as NC or NO switches. There are two types of electromechanical switches:

1. Mechanical inertia switch
2. Mercury switch

A mechanical inertia switch uses a seismic mass to open and close its contacts.



Information

In a normally closed circuit, the seismic mass rests upon the two contacts. When vibrated, it will bounce vertically to open the switch. A number of these open circuit pulses will signal an alarm condition.

Mercury switches consist of two electrical contacts in a small glass vial of mercury. The mercury conducts between the two contacts. During a vibration, the mercury is thrown free of the contacts for a moment. During this short period of time, the circuit is open. The break in the closed circuit is signaled to the processor. After a series of open circuit impulses, the system will alarm.

Electromechanical sensors are wired to fence posts every 15-20 feet. Protection zones should not exceed a length of over 300 feet. Usually the sensor cable is routed along the fence line. It is recommended that sensor cables be placed in conduit and that the sensors be placed in an enclosed box.

ELECTRET CABLE TRANSDUCERS

The electret cable transducer is a special type of coaxial cable. The center carries an electrostatic charged dielectric material. Under stress, the cable produces electrical signals. These signals are transmitted down the cable to a signal processor. A band pass filter is used to screen out unwanted signals. The signal-to-noise ratio is greatly improved by the use of the band pass filter. Filtering reduces the number of false alarms in the system.

The electret cable is microphonic in nature. It is possible for central station operators to listen to sounds that are transmitted through electret cable. This feature may help the monitor to identify the cause of some sounds.

A zone of protection should be less than 300 feet in length. Electret cable is suspended from the fence wire with plastic ties. The signal processor is enclosed in a watertight box with electromagnetic shielding. Rechargeable batteries are recommended as a backup for the signal processor.

TAUT WIRE SWITCHES

The taut wire switch is used as a detector on barb wire fences. It is wired in a normally open switch circuit. The switches are wired to individual strands of barb wire. When an intruder pulls on a wire, it closes the contacts of the switch.

Information

Taut wire switches are designed to alarm at the first pull on the wire. These switches should never be used with pulse count devices.

The switches must be installed for each strand of fence. Otherwise, the intruder might cut one wire and crawl through the fence without being detected.

Assignment

- Read Chapter 5, pages 65-76 in Intrusion Detection Systems: Principles of Operation and Application. Barnard, Robert L. Butterworth Publishers. Boston. 1981.
- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Job Sheet

SET UP A FENCE DISTURBANCE DETECTION SYSTEM

- Materials Needed
  - Transducers
  - Shielded cable
  - Signal processor
- Procedures
  - Wire in a fence disturbance system for one protection zone of 300 feet or less.
  - Follow manufacturer's specifications for adjusting the alarm signal.
  - Test system to see if it works.
- Resources
  - Instructor
  - Manufacturer's specifications

•Self Assessment

1. List five major kinds of fence distrubance sensors.

2. A piezoelectric crystal is made of ____________________.

3. What type of filter is used to screen out some frequencies of signals?

4. Piezoelectric transducers should be spaced every _______ feet along a fence.

5. Why is shielded cable used for wiring piezoelectric transducers?

6. A geophone is made of a coil of wire, permanent magnet and a _____________

_____________________.

7. List two types of switches used in electromechanical transducers.

8. Protection zones for electromechanical transducers should not be more than

_____________________ feet of fence.

9. The electret transducer is made of a _____________cable.

10. Taut wire switches are used with _________ wire.

Self Assessment Answers

1. Piezoelectric transducers, electromechanical transducers, geophone transducers, electret transducer cable and taut wire switches.
2. Quartz
3. Band pass
4. 20 feet
5. Cut outside interference.
6. Seismic mass
7. Mechanical inertia and mercury switches.
8. 300 feet
9. Coaxial
10. Barb

INSTRUCTIONAL LEARNING SYSTEMS

Post Assessment

1. A ______________ converts one form of energy into another form.

2. A transducer that operates on a quartz crystal is called a ________________.

3. A transducer that is a specially treated coaxial cable is called an ______________________ transducer.

4. Mercury switches operate on a normally __________________ circuit.

5. The mechanical inertia switch operates when the _____________ ________________ opens or closes the contacts.

6. A transducer that is made of a coil of wire, permanent magnet and a seismic mass is a ______________ transducer.

7. What type of filter is used on electret cables to screen signals.

8. What is the purpose of filtering?

9. What is the application of taut wire switches?

10. What is the maximum length of fence to be included in one protection zone?

Instructor Post Assessment Answers

1. Transducer
2. Piezoelectric
3. Electret
4. Closed
5. Seismic mass
6. Geophone
7. Band pass
8. Reduce false alarms
9. On barbed wire fence
10. 300 feet

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Application. Butterworth Publishers, Boston, 1981.

INSTRUCTIONAL LEARNING SYSTEMS

14.3

ELECTRIC-FIELD SENSORS

Goal:

The apprentice will be able to describe electric-field sensors and their applications in outdoor security systems.

Performance Indicators:

1. Describe an electrostatic field.
2. Describe how field sensors operate.
3. Describe common applications of electric field sensors.

Study Guide

- Read the goal and performance indicators to find what is to be learned from package.
- Read vocabulary list to identify the new terms that will be introduced in package.
- Study the introduction and information sheets.
- Read assignment in supplementary reference.
- Complete the job sheet.
- Complete self assessment and check your answers with the answer sheet.
- Complete post assessment and have instructor score answers.

Vocabulary

- Capacitance detectors
- Crystal controlled generator
- Electric field sensor
- Electrostatic field
- Field wire
- Magnetic field
- Sense wire

Introduction

Some types of sensors require a force field in which to operate. The intruder creates an imbalance or break in the field and the system alarms.

Two types of fields are commonly used in detectors.

1) Electrostatic field is used in electric field sensors and capacitance detectors.
2) Magnetic field is used in strain-magnetic sensors.

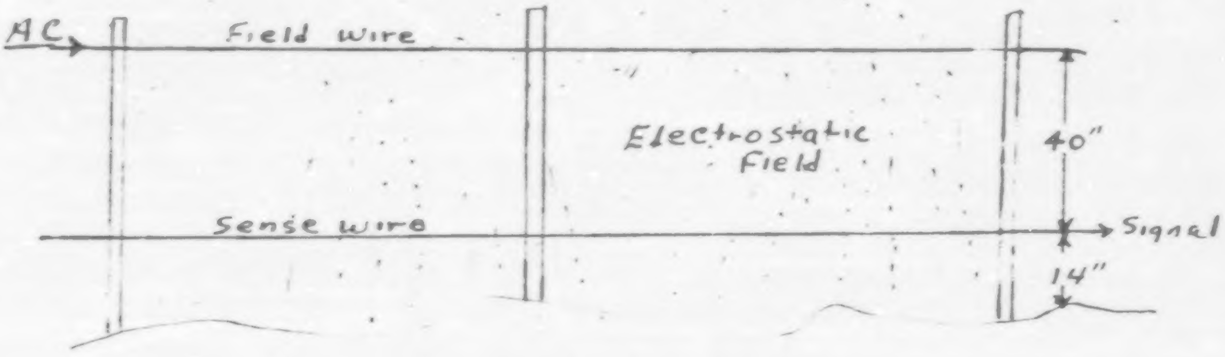
The applications of electrostatic fields and capacitance are discussed in a package on capacitance detectors.

This package will consider electric-field sensors and their applications in outdoor security.

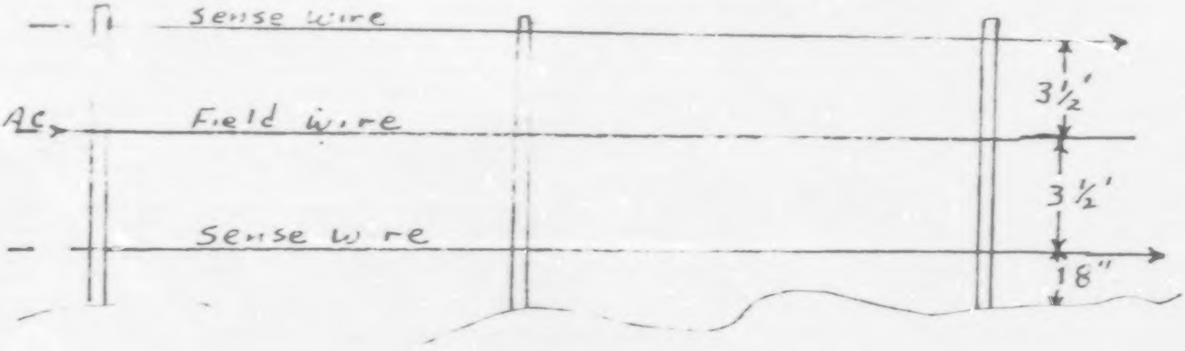
Information

Electric-field sensors generate a electrostatic field between two or more conductors. When the electrostatic field is established, a regular signal is being transmitted to the signal processor. If an intruder walks near the sensor, the electrostatic field is changed. Changes in the electrostatic field will change the signal pattern and the system will alarm.

The electrostatic field is made by passing AC current through a "field" wire by a crystal controlled generator. A "sense" wire picks up the signals from the electrostatic field.


AC
Field wire
Electrostatic Field
40"
Sense wire
Signal
14"

Three wire arrays are often used for electric-field sensors. The three wire array would be used to extend protection at the top and bottom of the fence.


Sense wire
AC
Field wire
3½'
3½'
Sense wire
18"

Information

In the three wire system, the electrostatic field extends upward and downward to the sense wires.

APPLICATIONS

Electric-field sensors can be used in zones up to 1500 feet in length. Most sensors are mounted on existing fence posts. In large systems that use many sensors, electrical interference between sensors may be a problem. The electrical interference can be controlled by using different frequency rates for the sensors.

The area underneath the electric-field sensor must be free of weeds and grass. If plants touch the sense wire, the system is likely to false alarm. The sensor must be adjusted to detect a walking person within two feet of the sensor. If the detection level is lower than that, it may not detect a crawling intruder. If a higher level detection is used, the system may have problems with false alarms.

Electric-field sensors are used in perimeter protection of industrial and commercial facilities.

A bandpass filter should be used to screen out high frequency signals such as wind vibrations and low frequency sounds such as flying objects.

Assignment

- Complete job sheet.
- Read Chapter 7, pages 93-97 in Intrusion Detection Systems: Principles of Operations and Applications.
- Complete self assessment.
- Complete post assessment.

Job Sheet

EXAMINE ELECTRIC-FIELD SENSOR DEVICES

- Ask journeyman installer to show you the generator, wire and signal processor for an electric-field system.
- Read the specifications for each of the system components.
- Find the components in a supply catalog.
    - Do you find special adaptations of the electric-field sensor?
    - Are the specifications of a standard size and configuration?
    - What are the recommended applications?
    - Does the supply catalog give limitations of equipment?

Self Assessment

1. Where are electric-field sensors commonly used?

2. AC current is passed through the ____________ wire of a field sense detector.

3. The ____________ wire picks up signals from the electrostatic field.

4. A crystal controlled _____________________ is used to provide AC current to the sensor.

5. The electric-field sensor alarms when the balance of the ______________ field is disturbed.

Self Assessment Answers

1. Along perimeters and fence lines
2. Field
3. Sense
4. Generator
5. Electrostatic

Post Assessment

1. Label the sense wire and field wire of an electric-field sensor.

2. How far apart should the two wires in Problem 1 be spaced?

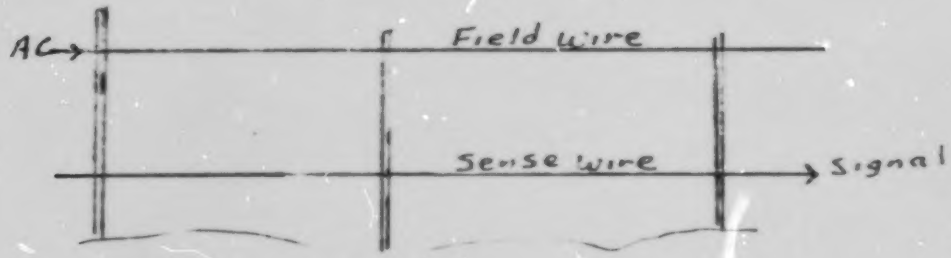
3. What generates the electrostatic field?

4. How is electrical interference between sensors controlled?

5. Why is a bandpass filter used in electric-field detection systems?

Instructor Post Assessment Answers

1.


AC
Field wire
Sense wire
Signal

2. 3½ feet

3. Crystal controlled generator

4. By using different frequency levels on competing sensors

5. To eliminate high and low frequency sounds that might cause false alarms.

Supplementary References

Barnard, Robert L. *Intrusion Detection Systems: Principles of Operation and Applications.* Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

14.4

SEISMIC SENSORS

Goal:

The apprentice will be able to describe seismic sensors and their applications.

Performance Indicators:

1. Describe applications of piezoelectric sensors.
2. Describe applications of geophone sensors.
3. Describe applications of strain magnetic sensors.

Study Guide

- Read the goal and performance indicators to find out what is to be learned from package.
- Read the vocabulary list to find the new words that will need to be learned.
- Study the introduction and information sheets.
- Read the assignment in the supplementary reference.
- Complete the job sheet if possible.
- Complete self-assessment and check answers with the answer sheet.
- Complete post assessment and ask the instructor to check your answer.

Vocabulary

- Bandpass filter
- Buried line sensor
- Discriminator sensor
- Dual channel signal processor
- Geophone transducers
- Passive transducer cable
- piezoelectric transducer
- Strain/magnetic line sensors

Introduction

The principle of seismic energy has many applications such as earthquake warning stations. The Plains Indians used seismic energy to detect approaching buffalo herds. They placed their ear to the ground and sensed the vibrations caused by the hooves of the buffalo.

Electronic detectors are based on the ability of transducers to convert the seismic energy into electrical signals. The devices used for detecting seismic energy are far more sensitive than the ear of a Plains Indian. Skilled intruders walk more softly than a herd of buffalo and create less seismic energy. Seismic detectors can be an electronic ear that senses the approach of a burglar.

Information

Seismic detectors respond to footsteps and other disturbances that create a vibration. Vibration detectors for fence protection were discussed in a previous package. Another package dealt with vibration detectors in relation to structural and glass protection. This package will consider seismic devices for outdoor and vehicular security.

For protection of an outside area, seismic devices are usually used as buried line sensors. The sensors are buried underneath the area to be protected. When an intruder crosses the protected area, a seismic energy is picked up by the transducer. The transducer converts the seismic energy into an electrical signal. The signal processor acts on the electrical signal and triggers the alarm.

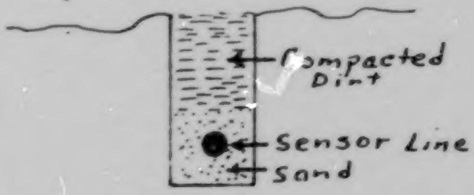
There are some basic types of seismic sensors:

1. Piezoelectric transducers that are used to detect short range seismic waves.
2. Geophone transducers that are used to detect longer range seismic waves.
3. Strain-magnetic line sensors that detect both seismic waves and ferrous metals carried by the intruder.

The geophone and piezoelectric devices used as buried line sensors are very much like those used in fence protection. The major difference is found in the frequency response for the two applications. Those differences are adjusted in the signal processor.

Piezoelectric Sensors

Piezoelectric sensors are made from quartz crystals. When pressure is applied on the crystal, it will produce an electrical signal. A footstep on the protected area will initiate a signal. The sensor lines are buried to a depth of 1½ feet. The sensor line should be placed in the middle of an 8 inch layer of sand.



Information

Transducers should be spaced every 18 inches along the sensor line. Some sensor lines will handle up to 100 transducers. Two of these sensor lines can be served by one signal processor. This means that one processor can handle 200 transducers that protect 300 feet of perimeter. It is important that the sand be compacted about the transducer and the trench should be backfilled with soil. The signal processor should be placed in an waterproof enclosure and buried with other parts of the system.

Geophone Transducers

A geophone transducer consists of a coil of wire, permanent magnet and a seismic mass. The coil of wire fits over the magnet which is attached to the geophone housing. When vibrated, the seismic mass acts upon the magnet and the geophone housing. The magnet is pushed back through the coil of wire and produces an electrical signal. The signal is read and acted upon by the signal processor.

Discriminator sensors are used to reduce false alarms from other sources of seismic energy. The commonly used discriminator sensors are geophones. The geophones are placed outside the protected area to pick up noises that may come from the street. The vibration of trucks and trains are picked up on the discrimination sensors before it reaches the area with the buried line sensors. These vibrations are sorted out by the signal processor so that they will not cause a false alarm.

Dual channel signal processors use two channels for processing signals. After processing, the output of the two channels are combined. If the signals satisfy both channels, the system will alarm. The dual channel processor reduces false alarming from outside vibrations.

Another system for controlling false alarms is the bandpass filter. The background seismic energy of the protected area is measured and compared with that of a person crossing the protected area. The bandpass of the filter is selected to detect intrusion without alarming to the seismic energy of the outside.

Audio features are sometimes used with geophone sensors. Trained central station operator can listen to the seismic signals and determine if the alarm is false.

Most geophone systems place 20-50 geophones on each sensor line. The geophones are placed 6-10 feet apart and each line will protect 200-300 feet of perimeter. The geophones should be placed in a layer of sand. The trench must be backfilled with tamped soil. The geophones must be packed tightly against the soil in order to sense vibrations.

Information

Geophones should be placed away from trees, telephone poles and light poles. Those objects tend to sway in the wind and create seismic patterns in the ground. Some thumbrules for avoiding these objects are:

1. Stay at least 10 feet from fence line.
2. Stay at least 30 feet back from the drip line of trees.
3. Stay back from telephone and light poles a distance equal to their height.

Strain Magnetic Line Sensors

The strain/magnetic line sensor detects seismic waves and ferrous metals carried by the intruder. A passive transducer cable is made by winding sense coils about a magnetic core. The weight of an intruder causes stress on the magnetic core which generates a signal. A signal is also produced if someone crosses the cable with ferrous materials such as tools and belt buckles. Signals from the seismic disturbance or from ferrous materials is processed by the signal processor.

A dual channel processing system is used to reduce false alarms. The signal processor analyzes the signals from each bandpass filter separately. When the alarm requirements of each filter are met, the alarm is set off.

The passive transducer cable is used with an alarm electronics module. Alarm modules should be placed in a waterproof enclosure if they are to be buried in the ground.

Transducer cable can be purchased in 100 foot and 500 foot standard lengths. A usual procedure for burial of cable is to dig a trench that is 4 inches wide and 12 inches deep. A 2 inch layer of sand is placed in the bottom of the trench. After the cable is placed, add another 2 inches of sand over the cable. The sand and soil must be well compacted about the cable.

Assignment

- Read Chapter 8, pages 100 - 110 in Intrusion Detection Systems. Barnard, Robert L. Butterworth Publishers, 1981.
- Complete Job Sheet.
- Complete Self Assessment and check answers.
- Complete Post Assessment and have instructor score answers.

Job Sheet

- Ask instructor or journeyman to show you examples of piezoelectric, geophone and strain/magnetic sensors.
- Read manufacturers specifications and diagrams for installing each type of seismic sensor and controlling false alarms.
- Assist with the installation of a seismic sensor system if it can possibly be arranged with your work site.

Self Assessment

1. What is a buried line sensor?
2. What are piezoelectric sensors made from?
3. Why should the sand and soil be compacted about a buried line sensor?
4. A geophone transducer uses a seismic mass, coil of wire and a ____________________ ____________________________.
5. List three techniques for control of false alarms in a geophone system.
6. One sensor line can handle __________ geophones.
7. Geophones should be placed at least _______ feet from fence lines.
8. The strain/magnetic sensor utilized a ________ transducer cable as a sensor.
9. The strain/magnetic sensor will detect ___________metals that are being carried or worn by the intruder.
10. An alarm electronics module is used with _________________ ________________ sensors.

Self Assessment Answers

1. A sensor that is placed beneath the ground.
2. Quartz crystal.
3. It must have contact in order to receive the seismic waves created by the intruder.
4. Permanent magnet.
5. Discriminator sensors, dual channel signal processor and bandpass filter.
6. 20 - 50
7. 10 feet

Passive

9. Ferrous
10. Strain/magnetic

Post Assessment

1. Describe the parts of a geophone transducer.

2. Describe how a piezoelectric sensor works.

3. Describe what is detected by a strain/magnetic sensor.

4. What is the purpose of discriminator sensors?

5. Which types of sensors need the discriminator sensor?

6. How far should geophones be from trees?

7. How far should geophones be from telephone poles?

8. How deep should passive transducer cable be buried?

9. How many geophones can be placed in one sensor line?

10. What are the standard lengths of passive transducer cable?

Instructor Post Assessment Answers

1. Coil of wire, permanent magnet and seismic mass.

2. Pressure on a quartz crystal generates voltage.

3. Strain/magnetic sensors detect both seismic energy and ferrous materials.

4. Reduce false alarms by cancelling outside seismic disturbances.

5. Geophone transducers.

6. 30 feet from drip line.

7. Distance equal to height of pole.

10 - 12 inches

9. 20 - 50

10. 100 feet and 500 feet

Supplementary References

* Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Application. Butterworth Publishers, Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

14.5

CAR ANNUNCIATORS

Goal:

The apprentice will be able to describe car annunciators and their applications.

Performance Indicators:

1. Describe conditions under which alarms are annunciated.
2. Describe types of annunciation devices.

Study Guide

- Read goal and performance indicators to find what is to be learned from package.
- Review trade terms on vocabulary list.
- Read introduction and information sheets for technical content.
- Complete the job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Vocabulary

- Anti-hijack device
- Anti-towing device
- Car annunciators
- Entry/exit delay system
- Wired systems
- Wireless systems

Introduction

Automobiles have become one of the biggest investments in American households. This investment is mobile and tempting to thieves. Car theft has become a major crime in the United States.

Auto security can be provided with minimum installation time. The average system involves protection of the openings into the car--the doors, trunk and hood.

Auto theft alarms are annunciated at the site of the intrusion. Loud sirens, bells, horns or buzzers alert owners and others that tampering is taking place. Other types of annunciation is based on immobilizing the car. It may lock wheels or cut off fuel and ignition. The car becomes worthless to the thief and they move on.

Information

The most basic automotive alarm system is a simple perimeter type. When a thief opens any of the doors, trunk or hood a horn or siren is set off. This alerts the owner that their car is being entered. Other systems may turn off fuel, lock the wheels, or alarm when being lifted by a tow truck.

Cars may be protected by:

1. Wired systems
2. Wireless systems

Devices are designed to annunciate a car theft in the following ways:

- Sound a siren, horn or bell when the thief opens doors, trunk or hood of car.
- Sound alarm when the car is being jacked up for tire theft.
- Sound alarm when being lifted by a tow truck.
- Lock the ignition.
- Lock the wheels.
- Shut off fuel.
- Turn on strobe lights.

In addition to theft, there are anti-hijack devices that protect valuable cargoes by causing engine shutdown. The driver has no control of this system. Scheduled stops are pre-programmed by a dispatcher. If the driver opens a door by mistake, they have three minutes to pull off the road. A complete engine shutdown of both spark and fuel occurs. The driver must call the dispatcher for a new code number before restarting the engine.

Car annunciators are available in many shapes. Some of the common annunciator devices are shown below.

* Additional protection may be extended to boat trailers, tool boxes, et.
* Horn blast for 2 - 3 minutes.
* Alarm activated by door switch circuits.
* Connected to vehicle electrical system.
* 8 second delay allows entry and exit without alarm

Information

ANTI-HIJACK CONTROL BOX

- Valuable load protector.
- Pre-programmed by dispatcher.
- Solid state.
- Immobilizes ignition.

KEYLESS ALARM

- Not connected to ignition.
- Alarms when voltage changes by opening of door.
- Very high sound (114 decibel)
- 15 second entry/exit delay.

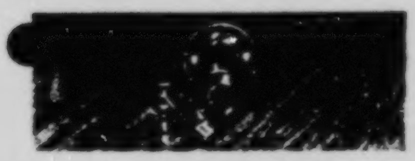
BRAKE SUPERVISOR

- Locks wheels on vehicle.

Information

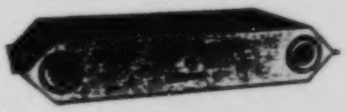
LOUD MOUTH ALARM

* All solid state, weatherproof unit.
* Produces a pulsating, wailing sound.
* Sensors come as wired and wireless.



REMOVAL RESISTANT
DOOR LOCK

* Cannot be pulled from door.



ULTRASONIC ALARM

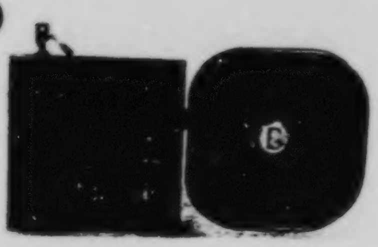
* Crystal controlled 12 V - DC.
* Bell/siren ringing alarm.
* Covers area 15' X 30'.
* LED walk test feature.
* False triggering rejection filters.

Information

PROTEKTOR
II

KEY OPERATED ALARM

- * Alarm controlled by ignition key.
- * System is automatically on when key is removed.



INFRARED DETECTOR

- * Uses passive infrared to sense body heat of thief.
- * Warbling siren alarm.
- * Used for truck/trailer protection.

ENTRY/EXIT DELAY SYSTEM

Most auto alarm systems have a delay feature. This allows the car owner time to get into the car or out of the car. The delay time may range from 10 seconds to 45 seconds. If the owner is slower than the delay time, the siren or horn will start blasting.

ANTI-TOWING DEVICES

Many car theft rings use a tow truck for stealing cars. With towing, they do not need to open doors and "hot wire" the car. Devices are available for detection of towing. Vibration sensors are used to detect the lifting of the car by a tow truck.

DEVICES TO PREVENT WHEEL AND TIRE THEFT

Switches and vibration sensors are available for the detection of wheel thieves.

Information

The vibration sensors alarm when a car is being jacked up.

VEHICLE DETECTORS

Another type of device is used to detect vehicle movement. A buried line sensor is attached to a control unit inside the building. When a car moves near the sensor line, an alarm will sound. This type of alarm is often annunciated by having a floodlight turn on and light up the area.

Assignment

- Complete job sheet assignment.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Job Sheet

EXAMINE CAR ANNUNCIATORS

- Visit a store that has a good supply of car annunciators.
- Identify annunciators that are available.
    - What are they used for?
    - How are they connected?
    - What type of annunciation is provided by each device?
    - What type of switch or sensor is used in the system?
- Draw a wiring diagram of a car annunciator that operates off of the ignition system.

•Self Assessment

1. What type of sensor would be used to detect a thief that is stealing tires and wheels?

2. What is the delay time for an exit/entry feature of car annunciators?

3. What does a brake supervisor device do?

4. One type of alarm system senses the body heat of the thief. This sensor is used in truck/trailer protection. What type of sensor is used in this device?

5. ___________________ sensors are used to prevent theft by towing.

Self Assessment Answers

1. Vibration

2. 10 - 45 seconds

3. Locks the wheels on the vehicle

4. Passive infrared

5. Vibration

Post Assessment

1. What is annunciation?

2. Annunciation may be made by wired or _____________ systems.

3. The most basic auto alarm system is a simple _____________ type.

4. What type of sensor would be used in an anti-towing device?

5. Why is an exit/entry delay feature important in car annunciators?

Instructor Post Assessment Answers

1. Method of communicating alarm condition. Sirens, bells and horns are examples.
2. Wireless
3. Perimeter
4. Vibration
5. Allows owner time to get in or out of car without it alarming.

Supplementary References

- Security Distributing and Marketing Magazines. Product Reviews. P.O. Box 272. Culver City, CA 90230. (Each issue has a product review section)

INSTRUCTIONAL LEARNING SYSTEMS

15.1

ANNUNCIATORS

Goal:

The apprentice will be able to describe audible and visual annunciation and its application.

Performance Indicators:

1. Describe audible annunciations.
2. Describe visual annunciators.
3. Describe applications of annunciators.

Study Guide

- Read the goal and performance indicators for this package.
- Read vocabulary list fo find new trade terms.
- Read the introduction and information sheets for technical information.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and ask the instructor to check your answers.

Vocabulary

- Audible annunciation
- Beepers
- Bells
- Blasters
- Buzzers
- Decibels
- Horns
- Howlers
- Light emitting diodes
- Mini-howlers
- Siren's
- Strobe lights
- Visual annunciation
- Xenon tubes

Introduction

When an alarm condition exists, someone must be alerted for action. This process of alerting people is called annunciaton of an alarm.

Annunciation can be made with loud and unusual noises. The noise must be above the normal sound threshold in order to get their attention. Sound alerts are called audible annunciation. Audible means that is something we can hear.

Lights are used as a way to annunciate an alarm condition. People can see flashing lights at night. The use of lights is called visual annunciation or something that we can see.

Information

AUDIBLE ANNUNCIATION

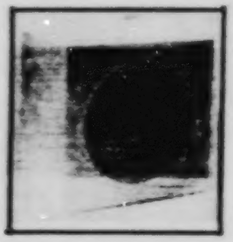
Audible annunciatoin is made by a wide assortment of noise-making devices. All are designed to annunciate an alarm status condition. The major types of audible annunciators are:

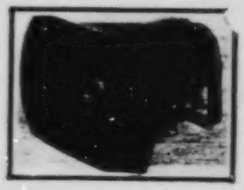
- Sirens
- Horns
- Bells
- Buzzers
- Beepers

SIRENS

Sirens are operated by a driver unit. The siren may be packaged separately from the driver or in a self-contained unit that is called a driver/speaker. The driver unit contains the electronic components that make the sound coming from the speaker. The speaker amplifies that sound. The output of a siren is measured by its sound level. That measurement is decibels or db. Many sirens have an output of 110 decibels. Sirens operate on 6 or 12 volt DC electricity in most applications. Most sirens are equipped with two channels so that two outputs can be made, depending on the alarm.

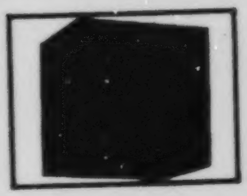
Sirens are made in two distinct sound patterns for burglary and fire alarms. Within those two patterns, they can be either "blasters" or "howlers". The blaster annunciates in blasts while the howler gives out a slow, lonely wail. Some of the typical sirens, siren drivers and speakers are shown in the following photographs.





Information

Cabinets are available for housing the speaker and driver units to protect them from environment and tampering. A tamper-proof cabinet is pictured below.



MPI-4 SPEAKER AND CABINET

Tamper-Proof Speaker — Same rugged construction as MPI-3 except 15 watt - 8 ohm speaker for medium power uses.

HORNS

Horns are commonly used as an indoor annunciation of fire alarms. Most horns are packaged in attractive housings to fit with the furnishings of a home. Horns operate on 6 and 12 volt DC or AC/DC electricity. These devices are excellent for sounding fire alarms. Some typical units are shown in the following pictures.

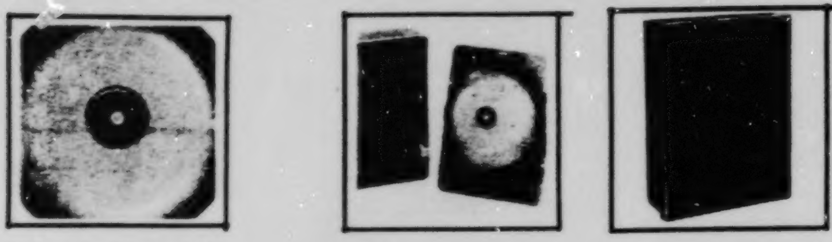
9205 INDOOR WARNING HORN

Attractive beige housing • 6VAC/DC, .6A • Dual horn elements • Ideal fire alarm sounding device

BELLS

Bells are used to annunciate fire and burglar alarms. They are usually housed in a tamper-proof metal box that is weather resistant. Bells can be purchased to operate on 6 and 12 volt DC or 24 and 110 volt AC power. Most systems that use bells have a bell cut-off module that turns the bell off in 15-30 minutes. Such an alarm cut-off module can be used with other annunciators such as sirens and horns. Some typical bell annunciators are pictured below.

Information

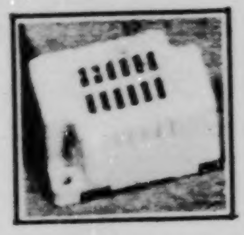


9209 BELL IN BOX

9265 10" vibrating bell in weather resistant outdoor housing • Bell mounted on hinged, lift-off baffle plate • Front and rear tamper switches • 6VDC, .75A • U.L. Listed • 98db at 10 feet

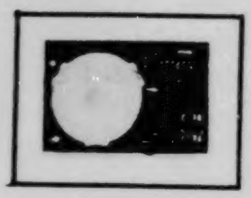
BUZZERS

Buzzers are used in some applications of annunciation. Many of the buzzers are piezoelectronic devices that use a transistor-oscillator-diode circuit. Some examples of solid state buzzers are pictured below. These devices will generate about 100 decibels.



BEEPERS

There are a number of annunciators that make beep, beep sounds. Most of these are piezelectronic devices that operate on 4 to 24 volt DC.



MINI-HOWLERS

Mini-howlers are used as an indoor warning device, an entry delay signal, or for monitoring a protective circuit. The mini-howler is usually operated on a 6 volt DC power supply. A picture of the mini-howler is shown below.

706/707 MINI-HOWLERS

Single tone (No. 706) or dual tone (No. 707) • Use with all 6 volt controls as indoor warning device, entry delay signaling unit or for monitoring the entire protective circuit • 707 can be wired to allow separate monitoring of the delay and regular protective circuits • Compact, loud and attractive

Information

VISUAL ANNUNCIATION

Visual annunciation is visible to the human eye. Lights are the most common visible annunciators. The strobe lights on police cars and fire trucks are good examples. Lights are visible at night which makes them a good alarm annunciator.

STROBE LIGHTS

Strobe lights are the most common form of light annunciation. In addition to fire, police and emergency use, strobe lights are used by highway departments as hazard warnings to motorists. A red strobe light shows emergency conditions. Yellow covers give us a flashing warning light. Strobe lights operate on 6 or 12 volt DC power. The lights are solid state devices with a Xenon tube. The lights can be purchased to flash form 60 to 100 flashes per minute. Common colors are clear, red, amber and blue. A strobe light is shown in the following picture.

1269 STROBE LIGHT
Clear cover • 12VDC operation • 60-90 times per minute flash rate

LIGHT EMITTING DIODES

LED's are used as annunciators in many alarm systems. The monitoring station operator sees the green light and knows that an alarm is being annunciated. LED's also tell us when a system is armed. Although LED's are not as impressive as a flashing strobe light, they are widely used to annunciate alarms.

FLOODLIGHTS AND SPOTLIGHTS

Many systems are designed to light up an area when the detector triggers an alarm. An alarm system may involve huge floodlights or bright spotlights to deter an intruder from further intrusion.

OTHER TYPES OF VISUAL ALARMS

There are many other types of visual annunciation that are used in special applications. Flags, semiphore signals and smoke signals have all been part of alarm systems. A good hunter observes the movements of small animals and birds as a visual annunciation of larger animals in an area. Most of these have no part in a modern alarm system.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

EXAMINE A SIREN DRIVER UNIT

- Obtain a siren driver unit.
- Remove the cover.
- Examine the electronic components that operate the driver.
- Draw a schematic of the driver/speaker circuit.

Self Assessment

1. List four types of audible annunciation.
2. List three types of visual annunciation.
3. Sound is measured in ________________.
4. Where are horns commonly used in alarm systems?
5. Are strobe lights a solid state device?

Self Assessment Answers

1. Horns, bells, buzzers, sirens, beepers

2. Strobe lights, LED's, floodlights

3. Decibels

4. Indoor fire alarms

5. Yes

Post Assessment

1. What is the unit of measurement for sound?

2. What is the most popular form of visual annunciation?

3. List two sound patterns that are found in sirens?

4. ________________ are a piezoelectronic device.

5. Mini-howlers are mainly used ________________ annunciation.
INDOOR, OUTDOOR

Instructor Post Assessment Answers

1. Decibel (db)

2. Strobe lights

3. Police and fire (Howler, blaster)

4. Buzzers or beepers

5. Indoor

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. 90230. (Past issues).

INSTRUCTIONAL LEARNING SYSTEMS

15.2

FIRE EXTINGUISHING SYSTEMS

Goal:

The apprentice will be able to describe extinguishing systems and their applications.

Performance Indicators:

1. Describe waterflow control devices.
2. Describe air flow control devices.
3. Describe applications of extinguishing devices.

Study Guide

- Read the goal and performance indicators.
- Read the vocabulary list.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Air duct control
- Air pressure supervisory switch
- Alarm check valve
- Door holder/closer device
- Fire doors
- Plug type supervisory switch
- Post indicator supervisory switch
- Post indicator value
- Retard mechanism
- Screw and yoke supervisory switch
- Waterflow switch
- Vane type waterflow switch

Introduction

Early detection of fires saves many lives. A quick response to alarms can save the property. A fire is easy to extinguish in its early stages. Some action should be taken while the response force is coming to the fire.

A good extinguishing system will slow the fire down until the response force arrives. Fire can be slowed down by dousing it with water and cutting off its oxygen supply.

This package will explain some of the devices used in extinguishing systems. The devices that control the water and the oxygen supply will be described.

Information

WATER CONTROL SYSTEMS

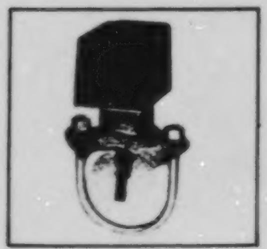
Fire alarms are often linked with a sprinkler system for extinguishing the fire. The sprinkler system is turned on with the alarm. The biggest concern is that the sprinkler system continues to operate. Fires are often troubled with explosions, drops in water pressure and other malfunctions. A sprinkler has a number of switches that turn on the sprinklers and then monitor the system to keep the water coming.

This package will discuss some of the devices of an extinguishing system.

Waterflow Switches

The waterflow switch is turned on with the alarm. It supervises the flow of water in the sprinkler pipes. Waterflow switches are designed to operate on a normally open circuit. When the system alarms, the contacts close. The rise and fall of water pressures can create problems with a waterflow switch. To avoid problems, a retard mechanism is built into the switch. The retard mechanism is operated on air pressure and protects the switch from quick changes in water pressure.

Sprinkler systems may or may not use an alarm check valve. A special waterflow switch is used in systems that do not use an alarm check valve. It is called a vane type waterflow switch. The vane type switch operates with up to 450 pounds per square inch (psi) of line pressure. A waterflow switch is shown below.



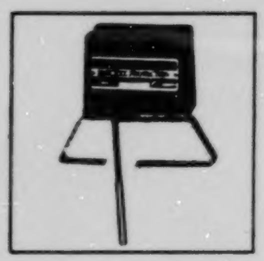
sprinkler
flow switches

Supervisory Switches

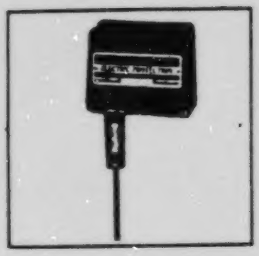
Supervisory switches are used to monitor the water system. One type is the air pressure supervisory switch which monitors air and water pressure on sprinkler systems. This switch is known as an explosion proof switch. The switch is factory adjusted to 40 psi. A 10 psi increase or decrease in pressure will cause it to alarm.

Information

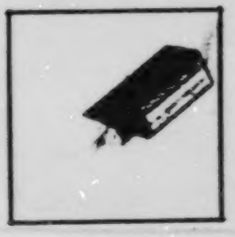
A screw and yoke supervisory switch monitors the open position of a screw and yoke gate valve.



A third type of supervisory switch is used to monitor the open position of the post indicator valve. This switch is called the post indicator supervisory switch.



The plug type supervisory switch supervises the open position of sprinkler system gates. This valve is used with normally closed circuits.



Plug Type Supervisory Switch

The Model PTS is designed to supervise the open position of sprinkler system gate valves. This device is specifically used on valves that are non-rising stem or on valves that are in pits which are subject to flooding. The PTS has one set of S.P.S.T. normally closed contacts. (Not available with normally open contacts.).

Information

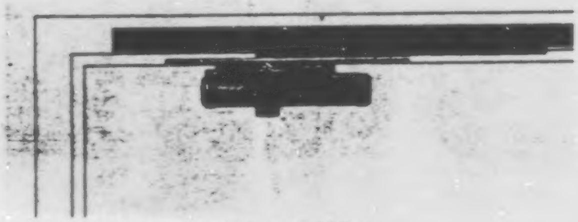
AIR CONTROL SYSTEMS

Fire must have oxygen. One method in extinguishing fires is to cut off the oxygen supply.

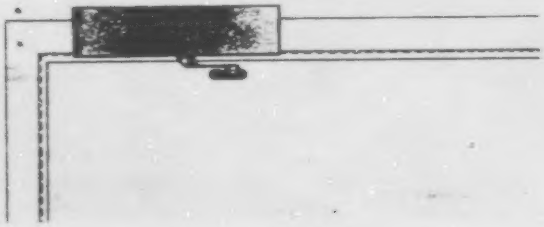
Fire Doors

Some systems use a door closer/holder device that closes the doors at the fire alarm signal. This keeps the fire from spreading and separates people from the dangers of smoke. The closer/holder is a fail/safe release mechanism that automatically closes doors on a signal. Examples of door holders are shown in the following pictures.

Multi-Point Hold Open with Detector
Exposed Models Only



Single Point Hold Open
Exposed or Concealed as shown



Multi-Point Hold Open
Exposed as Shown or Concealed

Information

Air Duct Control

Commercial and industrial applications often have electronic controls for the air duct system. This system can be wired to close at the alarm signal. The fire can be slowed down by closing the natural flues of a duct system.

Assignment

- Complete the Job Sheet.
- Complete self assessment and check your own answers with the answer sheet.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

INSPECT A SPRINKLER EXTINGUISHING SYSTEM

- Visit a site that has a sprinkler system that is linked with the alarm system. Ask someone that knows the system to explain how it works.
- Identify control devices and their location.
- Sketch a block diagram of the total system and how the sprinkler and alarm systems relate to each other.

Self Assessment

1. An ____________ ____________ ____________ switch monitors air and water pressure.

2. Gate valves are monitored by a ______________ and ___________ supervisory switch.

3. A ______________ type switch is used to monitor the waterflow of systems that do not have an alarm check valve.

4. A plug type supervisory switch operates on a normally ________________ circuit.

5. Give two reasons for installing automatic door closer/holders.

Self Assessment Answers

1. Air pressure supervisory switch.

2. Screw and yoke supervisory switch.

3. Vane

4. Normally closed circuit.

5. Slows the spread of the fire and separates humans from danger of smoke.

Post Assessment

1. List two methods for cutting oxygen away from a fire.

2. What monitors the post-indicator valve in a fire extinguishing system?

3. What is used to monitor waterflow in a sprinkler system?

4. What is used to monitor the gate valves?

5. What type of waterflow switch is used in systems that do not have an alarm check valve?

Instructor Post Assessment Answers

1. Door closer/holder and airduct control.
2. Post-indicator supervisory switch.
3. Waterflow switches.
4. Screw and yoke supervisory switch.
5. Vane type.

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. 90230. (Past issues have articles on fire systems).

INSTRUCTIONAL LEARNING SYSTEMS

15.3

SIGNAL REPORTING SYSTEMS

Goal:

The apprentice will be able to describe signal reporting systems and their applications.

Performance Indicators:

1. Describe DC wired systems.
2. Describe AC wired systems.
3. Describe McCulloh circuit.
4. Describe tape dialers.
5. Describe digital communicators.
6. Describe wireless reporting systems.
7. Describe applications of reporting systems.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- AC wired systems
- DC wired systems
- Dedicated metallic phone wires
- Electromagnetic interference
- Frequency division multiplexing (FDM)
- Interrogation -- response system
- Interrogator unit
- McCulloh circuit
- Modem
- Time division multiplexing (TDM)
- Transponder
- Wireless systems

Introduction

A signal must reach a response force if any benefit is to be derived from an alarm. Quite often the response force is at a location away from the protected area. Central stations have been developed for the purpose of monitoring alarm signals from many customers. The central station will receive the alarm signal and alert a response force.

A reporting system must be reliable and difficult to compromise. Reporting must be a fast and efficient procedure. Several systems of reporting have been developed over the years. New digital reporting systems can handle hundreds of customers through the use of dialers and multiplexing.

This package will discuss the standard systems for reporting and transmitting signals to a monitoring station.

Information

When detection devices trigger an alarm, it is reported to a monitoring station. The monitoring station may be a large central station or a home owner that responds to alarms. In all cases, some system of reporting is used to get the alarm to a response force.

Several systems are used for reporting.

- DC wired system
- AC wired systems
- McCulloh circuits
- Tape dialer
- Digital communicator
- Multiplexing
- Wireless transmission

DC WIRED SYSTEM

The DC system requires a set of dedicated metallic wires between detectors and the monitoring station. This system is not being used much today because the metallic wire is not easy to buy. This system uses a balanced bridge circuit and various types of line supervision techniques.

AC WIRED SYSTEM

This system operates in the same way as the DC wired system. Dedicated metallic signal lines are not required. The signals are transmitted in audible tones. An AC bridge network is utilized along with line supervision. The AC wired system is becoming popular with central stations because metallic lines are not required. AC systems operate on voice-grade telephone lines.

McCULLOH CIRCUIT

McCulloh circuits are similar to party line telephones. A number of customers report on a single line. A transmitter at the protected site sends a coded signal to the station. Each customer has their own signal. A code wheel on the McCulloh circuit has teeth that spell out each code number by the way they are spaced. Each McCulloh circuit will service 20 or more customers. The advantage of the McCulloh

Information

circuit is that only one set of lines are required for several customers.

TAPE DIALERS

Telephone tape dialers have pre-recorded messages. When an alarm is triggered, the dialer will dial some pre-recorded numbers and deliver the message. This dialer uses an endless loop of audio recording tape. The telephone numbers to be called are recorded as tone pulses on the tape. The alarm message is a voice recording. Some cities prohibit the use of tape dialers that connect with local police departments. Many of the early tape dialers had problems with self-triggering of alarms. This problem has been partially corrected with improved design.

DIGITAL COMMUNICATORS

Digital communicators use standard dial phone lines. The digital communicator is an all electronic device. This gets rid of the mechanical tape problems of the tape dialer. The dialer must have a matching receiver in the central station. The receiver decodes the digital signals and displays them in a form that can be read by the station monitor. The digital receiver can communicate back to the dialer. It sends signals to acknowledge that the message has been received.

A digital dialer can be foiled by a burglar by cutting the phone line. This is the greatest disadvantage of the digital communicator.

MULTIPLEX SYSTEMS

Multiplexing is a fast growing concept in signal transmission. Several hundred customers can be serviced at one time. There are two basic multiplexing techniquees:

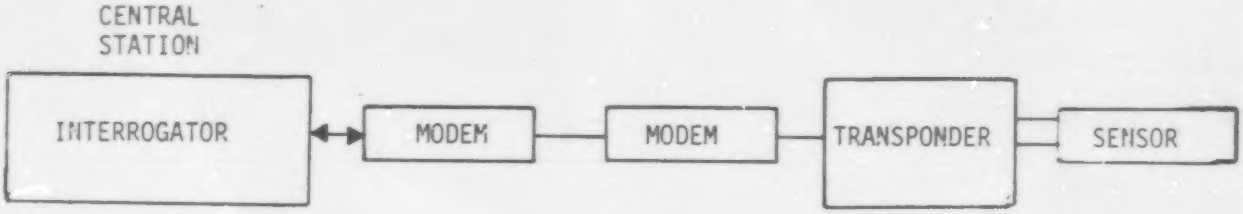
- Frequency division multiplexing
- Time division multiplexing

In FDM each channel is divided into many subchannels. Each subchannel is assigned to five customers. In TDM multiplexing, a time cycle is divided into many time slots of one second each. This allows the central station to communicate with 60 customers per minute.

The signals are transmitted in digital format through the use of modem. A transponder receives signals from the sensors. This signal is passed through a modem to be converted to digital. The signal is passed on to a modem at the central station. Here it is decoded for the interrogator unit. The interrogator unit is a receiver with the ability to communicate two ways. The interrogator asks for a status report

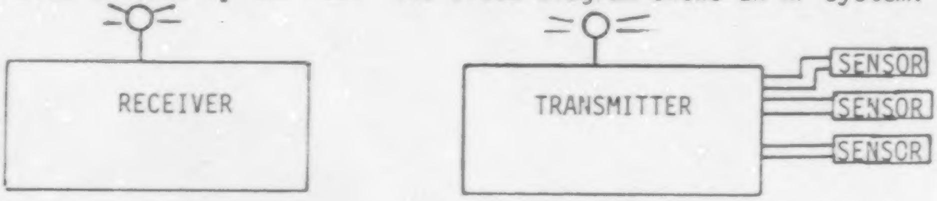
Information

at the protected area at frequent intervals. The transponder reports back that the area is alarm or secure. A typical interrogation-response system is shown in the diagram below.



WIRELESS SYSTEMS

Many remote stations use radio frequency transmission between the protected area and the central station. A radio transmitter is connected with the detectors by wire. When a signal is received from a detector, the transmitter sends the RF signal to a receiver. RF transmission is a line of sight system. The antennas of the transmitter and receiver must be in line and without major objects between them. Such objects as mountains may block the signals. The greatest problem with wireless systems is electromagnetic interference. Interference can make the message hard to understand. A typical RF transmission system will reach up to 50 miles on the frequencies allowed by the FCC. The block diagram shows an RF system.



Wireless systems are suited to remote areas that do not have available phone lines. Another application is for mobile equipment such as trucks, boats and trains.

Assignment

- Complete the job sheet.
- Complete self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Job Sheet

INVESTIGATE REPORTING SYSTEMS

- Arrange an interview with a journeyman installer.
- Ask journeyman installer to explain and sketch the reporting systems that they work with.
  - Which ones are most reliable?
  - What are the common problems?
  - What does an installer need to know about each system?
  - Where can the systems be observed in operation?

Self Assessment

1. Why are DC wired reporting systems not being used much in today's security systems?

2. The ______________ ________________ operates on the principle of the old party line telephone.

3. The ________________ dialer uses voice recorded messages.

4. A multiplexing system uses a __________________ to convert electrical signals into digital codes.

5. Name two types of multiplex techniques.

Self Assessment Answers

1. Metallic wire is hard to get.

2. McCulloh circuit

3. Tape

4. Modem

5. FDM -- Frequency division multiplexing

   TDM -- Time division multiplexing

Post Assessment

1. What is the biggest problem with wireless transmission?

2. The interrogator-reponse technique is part of a _____________ system.

3. Which system requires a set of dedicated metallic wires?

4. What was the major problem with early day tape dialer systems?

5. Which system uses a code wheel with spaced teeth to identify customers.

Instructor Post Assessment Answers

1. Interference

2. Multiplex

3. DC wired system

4. Self-triggering of alarms

5. McCulloh circuit

Supplementary References

- Barnard, Robert L. *Intrusion Detection Systems: Principles of Operation and Applications*. Butterworth Publishers. Boston, 1981.

INSTRUCTIONAL LEARNING SYSTEMS

16.1

DETECTION DEVICES

Goal:

The apprentice will be able to describe and classify basic detection devices.

Performance Indicators:

1. Describe basic detection devices.
2. Classify detection devices according to their use in an alarm system.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list to get acquainted with trade terms of package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Vocabulary

- Active barrier detectors
- Barrier penetration detector
- Buried line sensors
- Closed loop
- Electric field sensors
- Exterior detection devices
- Fence disturbence sensors
- Hold-up alarm
- Interior intrusion detectors.
- Invisible barrier detectors
- Ionization detectors
- Open loop
- Operable opening switches
- Proximity and point sensors
- Sensors
- Thermal detectors
- Time-lapse video recorder
- Ultraviolet and infrared flame detector
- Video surveillance systems
- Volumetric motion detector

Introduction

The numbers and types of detection devices are many. There are a wide range of technical concepts involved in detection devices. A complete understanding of the many devices will require a great deal of learning and practical experience.

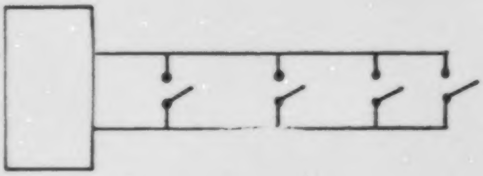
All detection devices are switches that activate an alarm system. These switches operate on open and closed loop circuits. If the installer will keep this switching function in mind, it will be easier to understand how different types of detectors work.

The installer should learn to classify detection devices according to their use in a system. When placed in logical groups, the detectors can be mastered with ease.

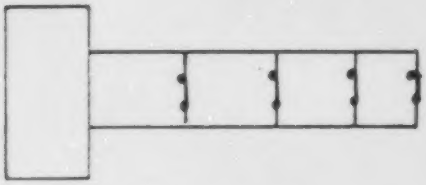
Information

Circuits

Basic detection devices are switches. These switches are part of a normally open or a normally closed electrical circuit. When the switch contacts open or close, the circuit is completed or broken. The switch operation activates the alarm process. A circuit with normally open switches is called an open loop.



A circuit that has its switches closed during armed status is called a closed loop.



Sensors

Detection devices that sense intruders or smoke are called sensors. The switch is affected by the condition enough to open or close. The sensor may be operated by seismic shock as in the case of geophone transducers or by temperature rise in the case of thermal fire detectors. In fact, most of the principles of science can be used to trip detector switches. Whichever principle is used, the basic component is a switch.

Fire Detection Devices

Fire detection devices are grouped as:

Information

1. Thermal detectors which are activated by heat of fire.
2. Photoelectric particle detectors which operate on the electric eye principle.
3. Ultraviolet and infrared flame detectors which only respond to flame.
4. Ionization detectors which react to combustion particles. These are the common smoke detectors.

Intrusion Detection Devices

Intrusion detection devices are grouped in several ways. One method of classifying detection devices is:

I. Exterior detection devices

  A. Fence disturbance sensors

    1. Electromechanical transducers
    2. Piezoelectric transducers
    3. Geophone transducers
    4. Eelctret cable transducer
    5. Taut wire switches

  B. Invisible barrier detectors

    1. Microwave
    2. Active infrared

  C. Buried line sensors

    1. Geophone transducers
    2. Piezoelectric transducers
    3. Strain/magnetic line sensors

II. Interior intrusion detectors

  A. Volumetric motion detectors

    1. Ultrasonic
    2. Microwave
    3. Sonic
    4. Passive infrared
    5. Passive audio

Information

B. Barrier penetration detectors

1. Structural vibration detectors
2. Glass breakage detectors
3. Heat sensors (safe and vault doors)
4. Foil tape
5. Breakwire grids

C. Operable opening switches

1. Balanced magnetic switches
2. Contact switches

D. Active barrier detectors

1. Photoelectric
2. Trip-wire devices

E. Proximity and point sensors

1. Capacitance sensors
2. Pressure mats
3. Point sensors

Hold-up Alarm Systems

Hold-up alarm systems have a few devices that are unique to the needs of such a system.

1. Foot rails that allow tellers to trip alarm with their toe.
2. Hold-up buttons that must be squeezed on each side to activate switch.
3. Money clips that have the contacts separated by two bills.
4. Traps that are designed so that hold-up bandit will trip their own alarm. These traps are designated as live and dead traps depending on whether it is set with an open or closed circuit.

Video Surveillance Systems

Video surveillance systems are also detection devices. Closed-circuit television is being used in access control systems, bank surveillance and other security applications.

Information

These systems are classified as:

1. Closed circuit video systems.
2. Closed circuit video tape recorder systems.

The time-lapse video recorder has applications where a taped record of surveillance is desired. Most banks use time-lapse CCTV.

Summary

All of these detection devices have switch contacts that open or close to alarm. The CCTV system is usually activated by other detection devices or is operated continuously in a time-lapse mode.

Assignment

- Review the supplementary reference to gain further knowledge on classification of intrusion detectors.
- Complete the Job Sheet.
- Complete the self-assessment and check answers.
- Complete the post-assessment and have the instructor check your answers.

Job Sheet

CLASSIFY DETECTION DEVICES

- Visit supply room with large assortment of detection devices.
- Classify devices according to the scheme learned in this package.
- Determine if this method of classifying devices makes sense.
- If it does not make sense, what method would be better.
- Discuss classification of devices with your instructor. Make sure that you use the same scheme for classifying detectors.

Self Assessment

1. List two basic types of circuits used in detection devices.

2. List two types of fire detection devices.

3. List three fence disturbance sensors.

4. List two invisible barrier detectors for exterior detection.

5. List three volumetric motion detectors.

6. List three types of proximity detectors.

7. List three hold-up alarm devices.

8. List two types of video surveillance systems.

9. List two types of operable opening switches.

10. List two barrier penetration detection devices.

Self Assessment Answers

1. Normally open and normally closed.

2. Thermal, photoelectric particle detector, ultraviolet and infrared flame detectors, ionization detector.

3. Electromechanical, piezoelectric, geophone and electret cable transducers. Taut wire switches.

4. Microwave and active infrared.

5. Ultrasonic, microwave, sonic, passive infrared, passive audio.

6. Capacitance sensors, pressure mats and point sensors.

7. Foot rails, money clips, hold-up buttons, traps.

8. CCTV video and video tape records.

9. Magnetic switch and contact switches.

10. Vibration detectors, glass breakage detectors, heat sensors, foil tape and break-wire grids.

Post Assessment

Classify the following devices according to their use as:

- Fire detection
- Hold-up detection
- Fence disturbance sensors
- Invisible barrier detectors (exterior)
- Buried line sensor
- Volumetric motion detector
- Barrier penetration detector
- Operable opening switch
- Proximity and point sensor

1. Capacitance sensor.

2. Infrared (passive)

3. Ultrasonic

4. Balanced magnetic switch

5. Geophone transducer

6. Glass breakage sensor

7. Microwave

Post Assessment

8. Ionization detector

9. Money clip

10. Infrared (active)

Instructor Post Assessment Answers

1. Proximity and point sensor
2. Volumetric motion detector
3. Volumetric motion detector
4. Operable opening switch
5. Fence disturbance sensor/vuried line sensor
6. Barrier penetration detector
7. Invisible barrier/volumetric motion
8. Fire detector.
9. Hold-up detector
10. Invisible barrier detector

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston, 1981.

INSTRUCTIONAL LEARNING SYSTEMS

16.2

CONTACTS

Goal:

The apprentice will be able to describe contacts and their application.

Performance Indicators:

1. Describe magnetic contacts.
2. Describe other types of contacts.
3. Describe applications for contacts.

Study Guide

- Read the goal and performance indicators. Find out what can be learned from this package.
- Read the vocabulary list. Get acquainted with new trade terms.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Built in mechanical magnetic shunt
- Built in status light
- Bullet nose sensor
- Double pole
- Double throw
- High security contacts
- Intermittent
- Jumper proof contacts
- Magnetic contacts
- Plunger type contacts
- Relays
- Ribbon switch
- Single pole
- Single throw
- Switch mats

Introduction

Contacts are the working parts of switches and relays. The alarm business uses many kinds, shapes and sizes of switches. Many switches are specially adapted to the security field.

The magnetic switch is the most common of contacts used in security alarm systems. Circuits may be wired with normally open circuits that alarm when the contacts are closed. Or normally closed switches may be used in an alarm system. The NC switch alarms when the contacts are separated.

A good knowledge of contacts is necessary for the installer of alarm systems. The contacts determine whether an alarm signal is transmitted to the signal processor. The installer must be able to select and install switches that will send a signal at the appropriate time.

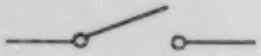
Information

Contacts are the points at which currents either make or break a circuit. Both switches and relays have contacts.

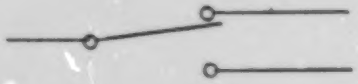
Contacts are described as:

- Single pole switches
- Double pole switches

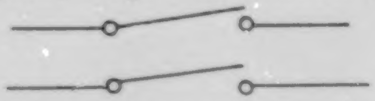
The single pole switch is SP and the double pole is DP. Switches are also designated as single throw and double throw (ST and DT). For example, the letters SPST means that the switch is a single pole, single throw switch.



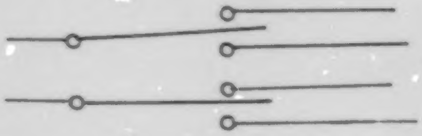
It is attached to one pole and, when thrown, touches one pole. A SPDT switch will be switched to another circuit when thrown.



A double pole, single throw switch (DPST) is either on or off.



The double pole, double throw (DPDT) is:



TYPES OF CONTACTS

Magnetic contacts. The magnetic switch is the workhorse of the security alarm industry. Reed type switches are magnetic contacts. These are used in protecting doors and windows. The magnet is mounted on the door and the metal bar is mounted on the door frame. As the door is opened, the two contacts are separated and the system alarms. Magnetic contacts can be bought in many shapes, sizes and for special purposes. Some typical magnetic switches are shown below.

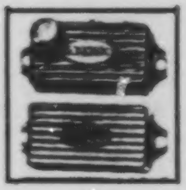
Information

40

NO. 40 SERIES WIDE GAP CONTACTS

Extra powerful • Up to 2" gap • Ideal for poorly fitted windows or doors • Lexan housing • U.L. Listed • Grey • 4 3/16" L x 1" W x 1" H • Complete with magnet

No. 40	SPST, closed circuit
No. 40-2	SPDT, closed or open circuit
No. 40SP	Same as No. 40 with extra holding power
No. 40-2SP	Same as No. 40-2 with extra holding power

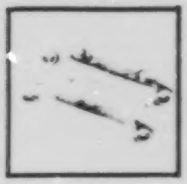


35

NO. 35 SERIES SHUNT CONTACTS

Magnetic contact with built-in shunt switch • Eliminates shunt locks and provides automatic bell test • To operate: arm control, depress button and open door • Alarm will not sound. Subsequent opening of door will sound alarm • U.L. Listed • Grade A approved • Complete with magnet

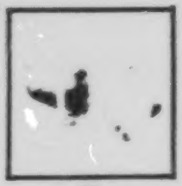
No. 35	SPST, closed circuit
No. 35-2	SPDT, closed or open circuit



13

NO. 13 REED SURFACE CONTACT

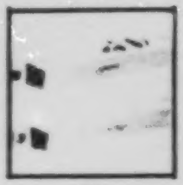
Economical • Ideal for damp climates • Hermetically sealed gold alloy plated contacts • ¼" gap • Grey • For closed circuit systems • 2 1/8" L x 3/8" W x ½" H • Complete with magnet



59

NO. 59 RECESSED CONTACT

Repel mechanism • Extremely difficult to defeat • Narrow beam magnetic field for high secutiry • Unique "Floating Magnet Action" • Completely concealed • Recesses into two ¾" holes • Maximum 1/16" gap for extra security • U.L. Listed • For closed circuit systems • Switch casing: 1" L x ¾" dia., Magnet casing: ½" L x ¾" dia., Flanges: 1 5/16" H x 1" W



46

NO. 46 SERIES WIDE GAP CONTACTS

Similar to No. 39, above, except up to 1 7/8" gap • U.L. Listed • Grey • 4¾" L x ½" W x 7/8" H • Complete with magnet

No. 46	SPST, closed circuit
No. 46-2	SPDT, closed or open circuit

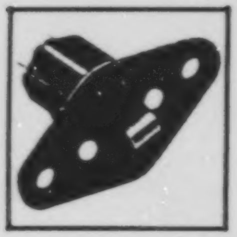
14

NO. 14 RECESSED REED CONTACT

Miniature size • Easily installed and concealed • 1/8" gap • 5" wire leads • Ideal for narrow frame windows and sliding glass doors • U.L. Listed • 1 5/16" L x 3/16" W (Base) x 9/16" W (Flange) • Complete with magnet

PLUNGER TYPE CONTACTS

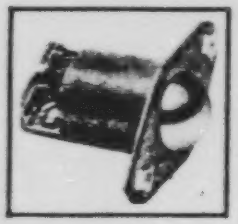
Plunger contacts are used in window protection. These switches are installed in a way that causes the plunger to be depressed when the window is moved. One of the most common of plunger contacts is the bullet nosed sensor. Some typical plunger contacts are shown in the following pictures.



NOS. 116T/117T PLUNGER CONTACTS

Cam action allows installation at top of doorway.

No. 116T	N.O. for closed circuit systems
No. 117T	N.C. for open circuit systems



NOS. 8/7 ALL PURPOSE CONTACT

Bullet nose design allows contact to be operated from slide pressure as well as conventional forward pressure. For 3/16" hole.

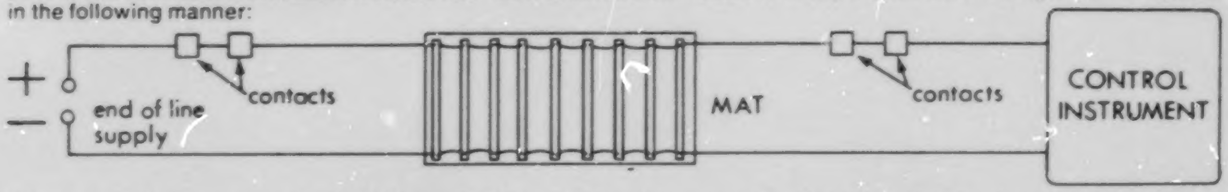
No. 8	N.O. for closed circuit systems
No. 7	N.C. for open circuit systems

Information

SWITCH MATS

Switch mats are installed where an intruder will step on them and trigger an alarm. Mats are commonly operated on closed circuits. The contacts are opened when a burglar steps on the mat and shorts the end-of-line supply. A diagram of a closed loop switch mat circuit is shown.

FOR A SUPERVISED INSTALLATION, the No. 158 mat can be connected into any closed-circuit burglar alarm system in the following manner:

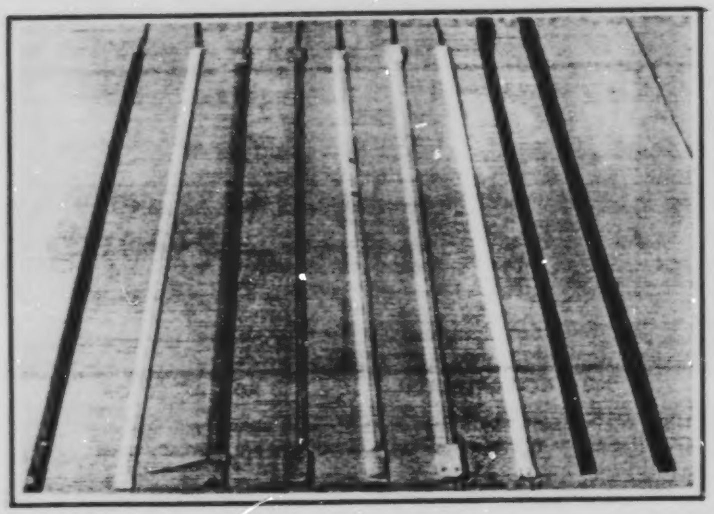


When a mat is stepped on, it shorts the end-of-line supply and causes the protective circuit relay to drop out. This method gives a completely supervised installation and is ideal for commercial installations.

RIBBON SWITCHES

Ribbon switches are normally open contacts for pilot controls. These switches are long and ribbon-like. They are usually fastened with adhesives to an object. Some heavy-duty ribbon switches are used to monitor traffic on a road. Ribbon switches are 3/4" to 1 3/4" wide and 3/16" to 1/2" thick. Standard lengths of ribbon switch are 1, 2, 5, 8, 10, 12, 15, 18 and 20 feet.

Some ribbon switches are shown below.



RIBBON SWITCHES

Tapeswitch "Controflex"® Ribbon switches are normally open momentary contactors for pilot controls or light duty actuation. These ribbon switches offer **press-at-any-point** control; they are **self-bottoming**; and they eliminate linkages required with other sensing switches.

Tapeswitches are moistureproof when factory supplied or properly sealed in the field. They are rugged with high quality contacts. See notes for ratings.

All switches are available in any length. The following factory lengths are standard: 1, 2, 5, 8, 10, 12, 15, 18, 20 ft.

Controflex ribbon switches can be mounted to most surfaces with vinyl adhesive sealant, or cut to any length and resealed. Submersion-proof switches must be so specified. Extruded Aluminum mounting channels are available for A, B, BP, and BPH profiles. Controflex Ribbon Switches lend themselves to the TAPESWITCH FAILSAFE circuit.

All Controflex Ribbon Switches may be coiled without shorting except style 180 Flex Switch.

Information

SPECIAL PURPOSE CONTACTS

There are several contacts that have been developed to meet special needs. These include:

- Built-in mechanical-magnetic shunt.

  These contacts have a rubber button that sticks up from the top. When a person wishes to arm the system, they hold down the button while opening the door. As they leave and close the door, the contact releases the shunt and the contact returns to normal operation.

- Built-in status light

  These contacts have an L.E.D. built-in to indicate protective loop status.

- High security contacts

  In cases where an intruder may defeat a standard system, a bias magnet is built-in the switch housing. If someone tries to defeat the system with a magnet, the system will alarm.

- Jumper proof contacts

  These special contacts have a built-in resistor and are wired in series. Any attempt to cut or short the wires or to bypass the contacts will alarm the system.

APPLICATIONS

Magnetic contacts are very reliable. The one problem that can cause trouble is an intermittent or "swinger." These swinger problems are very difficult to troubleshoot because they come and go.

An installer must depend on U.L. listings to determine the reliability of contacts. The letters AMQV on the U.L. listing indicates that the contacts meet their test requirements.

Magnetic contacts may have problems in such places as machine shops where metal particles will cling to the contacts. Moisture can also cause a problem by forming a shunt path for the signal.

Information

Switches are common to all detection devices. Magnetic switches are standard for interior perimeter protection of doors. Such circuits as foil tape, switch mats and plunger type switches are also used in perimeter detectors.

Relays are types of switches. The relay contacts are operated by electromagnetic energy between high and low voltage sources.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Job Sheet

INSPECT A VARIETY OF CONTACTS

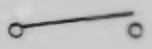
- Find a source for contacts.
  - Magnetic
  - Plunger-type
  - Ribbon switches
  - Special purpose
- Inspect each type of switch.
  - Note construction of switch
  - Note characteristics that can be identified for future reference
  - Note markings on switch
- Study manufacturer's specifications for switch
  - Open or closed circuit
  - Recommended applications

INSTRUCTIONAL LEARNING SYSTEMS

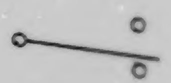
Self Assessment

What type of switches are shown below?

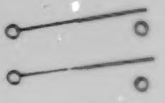
1.



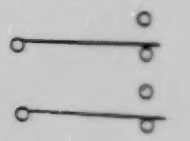
2.



3.



4.



5. What is a relay?

6. What type of a switch is the reed?

7. What is a bullet-nosed sensor?

8. What is a shunt used for?

9. An __________ is used as a status light to indicate the status of the protective loop.

10. What does the letters AMQV on an U.L. listing tell us about contacts?

Self Assessment Answers

1. SPST

2. SPDT

3. DPST

4. DPDT

5. A relay is a switch that is operated by electromagnetic force between a high and a low voltage field.

6. Magnetic

7. Plunger type switch.

8. To remove a part of the circuit from protected status.

9. LED

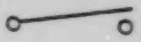
10. The contacts have passed the U.L. tests.

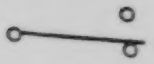
Post Assessment

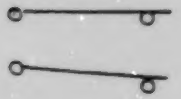
Draw the following switch arrangements.

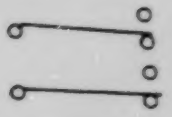
1. SPST
2. SPDT
3. DPST
4. DPDT
5. What is the difference between a switch and a relay?
6. List one type of magnetic switch used in alarm systems.
7. List one type of plunger switch used in alarm systems.
8. List two special purpose contacts.
9. What is the nickname of an intermittent?
10. What are ribbon switches normally used for?

Instructor Post Assessment Answers

1. 

2. 

3. 

4. 

5. A relay is operated by the electromagnetic energy between high and low voltage sources. Switches are operated manually.

6. Reed

7. Bullet nosed sensor.

8. Built in mechanical-magnetic shunt, built-in status light, high security contacts, jumper proof contacts.

9. Swinger

10. Pilot controls.

Supplementary References

- Security, Distributing and Marketing Magazine, P.O. Box 272, Culver City, CA. 90230.

INSTRUCTIONAL LEARNING SYSTEMS

16.3

VOLUMETRIC AND SPACE DEVICES

Goal:

The apprentice will be able to describe space and volumetric input devices.

Performance Indicators:

1. Describe space and volumetric devices.
2. Classify space and volumetric devices as motion detectors, stress detectors, proximity devices, gas detectors and photo-electric devices.

Study Guide

- Read the goal and performance indicators.
- Read the vocabulary list.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self-assessment and check answers.
- Complete the post-assessment and have the instructor check your answers.

Vocabulary

- Active motion detector
- Capacitance devices
- Gas detection deivces
- Microwave
- Passive audio detectors
- Passive infrared detectors
- Passive motion detector
- Photoelectric devices
- Sonic devices
- Stress detection
- Ultrasonic devices

Introduction

Detection devices are the workhorses of alarm systems. The installer must be able to select devices that are appropriate to each installation.

A number of detectors are known as space and volumetric devices. Such devices are used to protect space and volume that an intruder must cross to reach the protected item. Fire and smoke sensors are also space and volumetric devices. A sensor that detects fumes of toxic substances is also a volumetric device.

This package is designed to help the apprentice in classifying space and volumetric devices into groups. The ability to group the many devices according to their function will make it easier to make wise choices on detectors. Choices can be made from a few detectors that serve a specific function rather than from a hodgepodge of detection devices.

Information

Space and Volumetric Devices

Volumetric detectors are called motion detectors. Motion detectors are classified as active and passive detectors. The common motion detectors are classified below.

Active Motion Detectors

- Ultrasonic
- Microwave
- Sonic

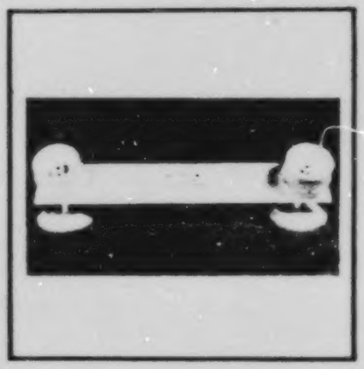
Passive Motion Detectors

- Passive infrared
- Passive audio

Ultrasonic Detectors

The ultrasonic motion detector consists of a transmitter, receiver and a control unit. The transmitter sends out an accoustical energy pattern that fills up the detection zone. The reflected energy is picked up by the receiver and processed by the signal processor. The reflected energy is of the same frequency as the transmitted energy. When an intruder moves into this energy pattern, the signal is changed. The ultrasonic detector works on the principle of the Doppler frequency shift. The transmitter and receiver are often housed in one unit. This type of unit is called a transceiver.

The control box of an ultrasonic detector contains a signal processor, power supply and stand-by battery system. An ultrasonic transceiver unit is shown below.



Information

The ultrasonic systems can be operated as master-slave units. Many transceivers can be controlled by one signal processor.

Microwave

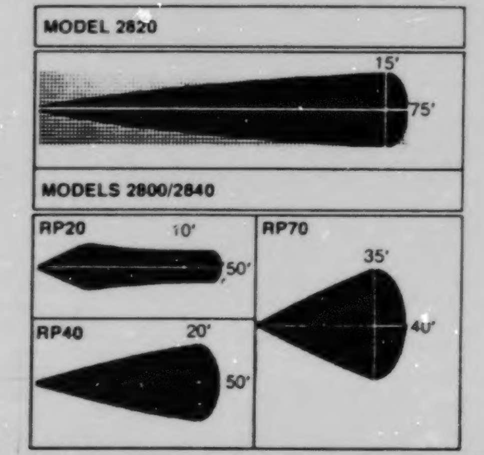
Microwave is actually a form of radar. The FCC regulates the frequencies that can be used in radar transmission. The allowable frequencies all fall within the microwave range. The microwave sends out a radiation pattern at 10,525 MHz. An intruder will interrupt that pattern and cause a Doppler frequency shift which is converted into an alarm signal.

Microwave detectors consist of a single unit that contains a detector antenna, power supply and signal processor. Some problems are found in making microwave installations. The ability of microwave to penetrate walls can lead to false alarms. If care is not given to its location, the microwave unit may pick up motion through the walls of the building.

The shape of the antenna determines the microwave pattern of detection. Many configurations of antennas are available.

A microwave (self-contained) unit is shown in the following picture.

Some typical microwave patterns are shown.



Information

Sonic

Sonic detectors use an audible frequency range. The detector consists of a control unit and a transceiver unit. The transceiver unit are electromagnetic speaker transducers. Each transceiver unit can protect a volume of 40' x 40' x 10'. One control unit can handle 7 to 8 transceiver units. The system is audible and may be irritating for those that have to be in the area while the system is turned on.

Passive Infrared

Infrared detects body temperature. When an intruder walks into the infrared pattern, thermal sensors detect the change and trigger an alarm. Infrared detectors are self-contained units. A signal processor, thermal sensor and power supply are contained in one unit. Passive infrared can be installed as master-slave units with one master control unit for several slave detector units.

Passive Audio Detectors

Audio detectors listen for audible noise. When an intruder breaks into a protected area, the audio detector will alarm. The detector must be adjusted to handle normal noises without alarming. Several techniques are used to avoid false alarms. Those techniques include the use of cancellation·microphones and pulse count circuits. Audio systems are often used in schools because the detectors can be wired into the public address system for the school.

Stress Detectors

There are several types of detectors that operate on stress and strain that is applied to the protected area. Stress detectors include glass breakage sensors, vibration detectors and seismic operated devices. Foil tape is also a stress detector used in window protection. Several types of fence sensors are operated by stress on the wire.

Gas Detection Devices

Gas detection devices are used to detect gases in a protected area. These sensors detect the vapors of kerosene, solvents, hydrogen, ammonia, carbon monoxide and other hazardous materials.

Information

Sound Discrimination Devices

A sound discrimination device uses amplifiers with filters to discriminate between sounds. These devices require careful adjustments to avoid false alarms. The discriminator must be able to ignore the background sounds and still alarm when an intrusion occurs. These devices differ from audio systems that "listen in" on sounds. The discriminator must make its own decision on whether the alarm should be triggered.

Capacitance Devices

Capacitance detectors are used to protect items such as vaults and filing cabinets. The device sets up an electrostatic field about the protected object. When an intruder enters this field, the capacitance is changed and an alarm is triggered. These devices are called proximity sensors because the intruder must be very close to the object to activate the alarm.

Photoelectric Devices

Photoelectric (electric eye) devices are used to set up protection barriers. When an intruder crosses the beam of the device, an alarm is set off. Three types of light sources (beams) are used in photoelectric devices. Light emitting diodes, incandescent light and infrared may be used to provide the beam. Infrared and LED's are invisible forms of light. The incandescent light can be seen by the intruder and is used in non-security applications.

Assignment

- Complete the Job Sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

CLASSIFY DETECTION DEVICES

List detection devices into categories according to their function.

Motion Detectors	Noise Devices	Stress Devices	Proximity Devices	Electric Eye Devices

Self Assessment

1. List two active motion detection devices.

2. List two passive motion detection devices.

3. The ________________ frequency shift is the principle for operation of ultrasonic and microwave detectors.

4. ____________________ detectors sense body temperatures in the protected area.

5. Capacitance detectors alarm when an intruder breaks the capacitance of an ____________________ field.

Self Assessment Answers

1. Ultrasonic, microwave, sonic

2. Passive infrared and passive audio

3. Doppler

4. Infrared

5. Electrostatic

•Post Assessment

1. A form of radar used in motion detectors is called ____________________.

2. An active motion detector that works at audible frequency range is ___________.

3. List two examples of stress detection devices.

4. What is the major problem with sound discrimination devices?

5. List two types of beams used in photoelectric devices.

Instructor
Post Assessment Answers

1. Microwave

2. Sonic

3. Vibration sensors, glass breakage sensors, foil tape, seismic devices.

4. False alarming from unusual noise levels.

5. LED's, incandescent light, infrared.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston, 1981.

INSTRUCTIONAL LEARNING SYSTEMS

16.4

PROBLEMS AND APPLICATIONS OF DEVICES

Goal:

The apprentice will be able to describe common problems and applications of detection devices.

Performance Indicators:

1. Describe problems of various detection devices.
2. Describe general applications of various detection devices.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list to learn new trade terms to be learned.
- Read the introduction and information sheets for technical information.
- Complete the job sheet.
- Complete the self assessment and check answers with answer sheet.
- Complete the post assessment and have instructor check your answers.

Vocabulary

- Active volumetric device
- Capacitance detector
- Microwave motion detector
- Passive infrared
- Passive volumetric device
- Photoelectric beams
- Proximity device
- Seismic
- Sound system
- Stress detector
- Ultrasonic motion detector

Introduction

Detection devices have a range of applications. Some applications are more suited to the device than others. A device will tend to have fewer problems when the appropriate application is made of the device.

All detection devices have problems with false alarms and failure to alarm. Problems can be greatly reduced by making proper applications.

This package will highlight the problems of each type of detection device and show the application for which it is most suitable.

Information

The following chart lists common types of detection devices, their problems and their most appropriate applications.

DEVICE	PROBLEMS	APPLICATIONS
Photoelectric Beams	Cold weather may cause frosting of optical parts of system. Strong sunlight on the receiver may cause false alarm. Grass, shrubs and trees may grow and break the beam. Beam interruptions caused by animals, insects, parked cars, etc. will cause false alarm.	Used to establish protection both inside and outside of buildings. Used on entrance ways and other access routes.
Passive infrared	Temperature changes from heaters, lights and air ducts may cause enough thermal change to alarm the system. Dogs, cats and other animals may produce enough body heat to alarm the system.	Wide angle patterns are used to cover a room. Narrow angle patterns are used for aisles, hallways.

Information

DEVICE	PROBLEMS	APPLICATIONS
Ultrasonic Motion Detectors (Active Volumetric Device)	Audible noises such as gas leaks, whistles, machinery will cause a false alarm. Telephone bells that ring at random times may cause problems with false alarms. Changes in temperature and relative humidity may help to create false alarms. Air turbulence from fans and air conditioners can cause false alarm. Objects in motion within the protected areas are problems, i.e. doors shaking in the wind, swinging signs.	Usually used to protect individual rooms or portions of a room.
Microwave Motion Detectors (Active Volumetric Device)	Microwave tends to penetrate walls and respond to motion on the other side. This creates false alarms. Failure to alarm because of transducer blockage by metal objects, X-mas ornaments, etc. Metal roofs, walls and doors shaking in the wind cause false alarms.	Outdoors within a fenced area as perimeter detection device. Indoors as a volumetric motion device.

Information

DEVICE	PROBLEM	APPLICATIONS
Microwave Motion Detectors (cont.)	Animals can cause problems. Two way radios can cause false alarms. Insects within the unit can false alarm the system.	
Capacitance Detectors (Proximity Device)	Problems occur if the protected item is not well insulated from the floor. Problems occur when the sensitivity level is set too high. (False alarms.) Problems occur when the system is not properly grounded. Problems occur when the sensitivity level is set too high to avoid false alarms. (Failure to alarm). Problems occur when too many objects are protected in one system. Follow manufacturer's directions.	Use to protect valuable item storage. Used on metal vaults, filing cabinets, etc.
Sound Detection Systems - "Listen in" Detectors - Sound Discrimination	Problems arise from unexpected noises that are not intruders. (False alarms)	Schools are a common application of sound detection devices. The devices can be wired into

Information

DEVICE	PROBLEM	APPLICATION
Sound Detection Systems (cont.)	The system fails to alarm if the sensitivity is too low. Cut or shorted microphone wires are a problem. Playing children, factory whistles, thunder and many other noises can alarm the system.	the public address system that already exists in the school.
Seismic Detectors	Any earth tremor will alarm the system. Vehicles, animals or other pressures that are unrelated to intrusion can false alarm the system.	Used as an exterior perimeter protection device.
Glass Breakage Detectors	Some are subject to corrosion which creates problems of alarm failure. Detectors can be removed from the glass. Settings may be too sensitive and create false alarms.	Used on windows to detect breaking glass.
Stress Detectors	Failure to alarm because of sensitivity levels transmitted through floors, etc.	Used on floor joists, fire escapes, etc. Intruders weight alarms system.

Assignment

- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

INTERVIEW A JOURNEYMAN INSTALLER ABOUT PROBLEMS AND APPLICATIONS OF DETECTION DEVICES.

- Arrange for an interview with a journeyman installer. Ask for ½-1 hour of their time.
- Ask the journeyman to describe the applications and problems for each detection device (in summary form of course).
- Make a set of notes to show:

DEVICE	PROBLEMS	APPLICATION

* Are the problems and applications consistent with the chart in this package? Did you learn others from the experiences of the journeyman?

Self Assessment

List one problem for each of the following detection devices.

1. Photoelectric beams
2. Passive infrared
3. Ultrasonic
4. Microwave
5. Capacitance
6. Audio
7. Seismic

List an appropriate application for each of the following devices.

8. Passive infrared
9. Ultrasonic
10. Capacitance

Self Assessment Answers

1. Cold weather, strong sunlight on receiver, plant growth breaking beam, beam interruption by animals, insects, cars, etc.
2. Temperature change from heaters, lights, etc; dogs, cats and other animals body heat.
3. Leaking gas, whistles, machinery, telephone bells, temperature change, air turbulence, moving objects such as wind rattled doors.
4. Penetration of walls beyond protected area; transducer blockage causes alarm failure when blocked by metal objects, X-mas ornaments, etc.
5. Improperly set sensitivity levels, lack of insulation between floor and protected item, poor ground, too many protected objects on one line.
6. Noises from other sources, sensitivity levels improperly adjusted, cut or shorted microphone wires.
7. Pressures from other sources may cause false alarms. i.e., animals, vehicles.
8. Rooms, hallways, aisles.
9. Individual rooms.
10. Protected items such as safes, vaults, paintings, file cabinets.

•Post Assessment

Which type of detector is affected by the following conditions to the point that it becomes a problem.

1. Penetration of walls beyond the protected area.
2. Reacts to the body temperature of stray dogs that wander through the protected area.
3. Fails to alarm because the transducer has been blocked by X-mas tree ornaments.
4. Fails to alarm because of corrosion.
5. False alarms because of tremors produced by an automobile passing over the protected area.
6. False alarms to the noise of playing children, factory whistles and thunder.
7. False alarms when insects crawl inside the unit.

Which device is best suited to the following applications:

8. As a beam barrier to protect entrance ways to a protected area.
9. As an active volumetric motion detector for an outside perimeter area.
10. As an active volumetric motion detector for a single room in the protected area.

Instructor Post Assessment Answers

1. Microwave

2. Passive infrared

3. Microwave

4. Glass breakage sensors

5. Seismic detectors

6. Audio systems

7. Microwave

8. Photoelectric

9. Microwave

10. Ultrasonic

Supplementary References

- Trimmer, William H. Understanding and Servicing Alarm Systems. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

17.1

KEY STATIONS

Goal:

The apprentice will be able to describe key stations and their applications in arming and zoning alarm systems.

Performance Indicators:

1. Describe on-off controls.
2. Describe day-night control feature.
3. Describe entry-exit delay feature.
4. Describe bell time-cut feature.
5. Describe low speed feature.
6. Describe momentary key switches.
7. Describe multiple zones.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list of new trade terms.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Armed
- Auxiliary features
- Bell time out feature
- Day-night feature
- Disarmed
- Drop relay
- Entry-exit delay feature
- Low speed feature
- Momentary key switches
- Multiple zones
- On-off switch control
- Panic circuit
- Protective loop
- Pulse stretchers
- Sensitive relay
- Zoning

Introduction

The control panel is a very important component of an alarm system. It allows the system to be disarmed while authorized people enter the protected area. While the system is armed, the control unit monitors the status of the protected loop. The control must maintain an alarm to let the response force know that intrusion is underway.

Key operated controls are very common in both commercial and residential systems. Even though many systems are now using keyless control stations, key stations will continue to play a role in security alarm systems.

The installer must understand the features of a key control unit. This will allow them to design a system that meets the needs of individual customers.

Information

A control is used to turn a system on and off. When a system is turned on it is armed. When turned off, it is disarmed. In early day systems, it was a matter of turning a switch on or off to arm or disarm it.

As systems became more complex, the practice of zoning was begun. Zoning is a matter of dividing large systems into zones or parts so that the monitor will know where the intrusion is being made. The response force can be directed to where they are needed without a loss of time in a zoned system. Zoning of large systems helps in troubleshooting problems that may arise in a system.

A control unit provides a means for monitoring the protective loop. In case of an intrusion, the control must provide an alarm to alert a monitor to the intrusion. The control must continue the alarm even after the protective loop has been restored.

Most new designs for control units use solid state devices such as transistors and integrated circuits. This package will deal with stations that use keys for arming and disarming the systems.

On-off Switch Control

Early controls consisted of an on-off switch and two types of relays. A sensitive relay was used to detect the status of the protective loop. The loop was either secure or not secure. A drop relay provided a continuous alarm until the system was manually turned off with a key. The protective loop could be restored without turning off the alarm.

Shunt Switches

The shunt switch is used to bypass an alarm system. The owner can shunt the system while he enters a door. Once inside they can disarm the total system at the control box.

Day-Night Feature

In simple control systems that have only one protective loop, the system is turned off during the day and armed during closed hours. New systems are wired so that some types of detectors operate both day and night. When a system is set for day, the night circuit is turned off. The "night" position turns on all parts of the system.

Information

Multiple Zones

The microcomputer is used in most complex multiple zone systems. Some of the more simple systems can be operated on key stations. One such system places all the zones on a night circuit and a few zones on the day circuit. This system of multiple zoning requires a minimum of switches. Each zone must be connected to the control box by a set of wires. Zoning requires additional labor and costs for installation.

Low Speed Feature

Electronic devices respond much faster than the old-fashioned relays. Sometimes the response is too fast and results in false alarms. Some systems use pulse stretchers to slow down the electronic response time. The need for pulse stretchers is dependent on the devices being used on a circuit. For example, glass breakage sensors are quick-response sensors and should not be slowed down with a pulse stretcher.

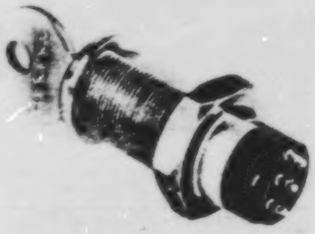
Bell Time Out Feature

A bell cut-off feature is used to limit the duration of alarms. Many cities have passed ordinances that limit the time that an alarm can ring. Most control units have a built-in feature that cuts the alarm bell off after a period of time.

Momentary Key Switches

Momentary key switches are operated on a spring return that will turn the system on and off. When the key is turned momentarily, the system is alternately on and off. An indicator light shows the owner whether the system is armed or disarmed. Momentary key switches are used in remote control stations. An owner of a residential alarm system may need 3 or 4 locations for arming and disarming the system. Two colors of indicator lights can be used in a remote system--one to show if the system is on or off and one to indicate if the loop is secure.

A security switch lock with momentary contact is shown below.



Information

Entry-Exit Delay Feature

In the past controls have used key switches or a shunt that is located outside the protected area. That system exposed switches to the weather and allowed intruders an opportunity to defeat the system. With the entry-exit control, the switch can be located inside the protected area. The system allows time for the owner to enter the building and disarm the system. Likewise, it allows time for them to arm the system and exit the building. The amount of time for entry or exit is preset on the control unit. The entry-exit delay feature can be used with remote stations and multi-zone systems. Some zones can operate on an instant alarm basis while other zones may have a delay feature.

Auxiliary Features

Controls may be used to operate a panic circuit in addition to burglar alarms. Fire alarm systems are often included with the burglar alarm control system. Residential applications may have burglar, fire and panic circuits on one control unit.

Types of Keys

There are several types of locks used in alarm systems. These include round key locks, flat key locks, rotary switch locks, cam locks and pick-resistant locks. These locks can be selected for on-off, shunt and momentary functions. A typical cam key lock and specifications are shown below.

Medeco Security Cam Locks are recognized by experts throughout the world as the standard for security in a ¾" diameter lock. No other lock of any size can rival Medeco in protection against surreptitious entry, resistance to physical attack and maintenance of key integrity. Ideal for control panel doors.

Assignment

- Read pages 147-158 in suplementary reference.
- Complete the job sheet.
- Complete the self assessment.
- Complete the post assessment and check your answers with the instructor.

Job Sheet

ANALYZE A CONTROL PANEL

- Obtain permission to inspect a control panel of a functioning system. Get a journeyman installer to explain the arming, disarming, zoning and special features of the control unit.
- Analyze the system.
  - Does it have a day-night feature?
  - Does it have an exit-entry delay feature? If so, how much delay?
  - Does it have a bell cut-off timer?
  - Does it use momentary key switches?
  - Does it have multiple zone control feature?
  - What kinds of alarm circuits are controlled by the unit?
  - How do different alarm systems relate to each other in control unit?

Self Assessment

1. What is zoning?

2. What are the advantages of zoning?

3. What is the purpose of a shunt?

4. What is day-night feature?

5. What is pulse stretcher used for?

6. Momentary key switches are used in ______________ control stations.

7. What is the purpose of an entry-exit delay feature on a control?

8. List two auxiliary features of a control unit other than burglar alarms.

9. Two colors of indicator lights are used in remote systems. One is to indicate whether the system is armed. What is the other light for?

10. What type of devices are used in new designs of control units?

Self Assessment Answers

1. Breaking a large system into sub-parts or zones of protection.

2. Allows response force to go directly to problem area. Easier for the installer to troubleshoot the system.

3. To shut off part of the system so that protected area **can be entered.** Once inside the person can disarm the total system at the control unit.

4. Allows parts of the system to operate during work hours and the total system to work at night. The operator merely turns control switch to day or night position.

5. Used to slow down electronic response time.

6. Remote

7. Delays alarm until owner enters or leaves building.

8. Fire and panic alarm systems.

9. To indicate if the protective loop is secure.

10. Solid state-transistors and integrated circuits.

Post Assessment

1. A ______________ switch is used to shut down a part of the system while the owner enters a building.

2. Remote control stations use ______________ key switches.

3. A device that is used to slow down the electronic response time of devices is called a ______________ stretcher.

4. Which other alarm systems can be operated on the same unit with a burglar alarm system?

5. A control feature that allows an owner time to enter or leave a building is called an ____________ ______________ ____________ feature.

6. On-off switch control units used two types of relays. One was a sensitive relay to detect the status of the protective loop. The other was a __________ relay which provided alarm.

7. Two colors of indicator lights are used in remote systems. One color indicates if the protective loop is secure. What is the purpose of the other light?

8. Can entry-exit feature be used in remote control stations?

9. List three types of locks used in security alarms.

10. What is the purpose of a bell cut off timer?

Instructor Post Assessment Answers

1. Shunt
2. Momentary
3. Pulse
4. Fire and panic
5. Entry-exit delay
6. Drop
7. To indicate if the system is armed
8. Yes
9. Round key locks, flat key locks, cam locks, pick-resistant locks, rotary switch locks.
10. Shuts off alarm bell after a period of time without shutting off the alarm system.

Supplementary References

- Trimmer, William H. *Understanding and Servicing Alarm Systems*. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

17.2

KEYLESS CONTROL STATIONS

Goal:

The apprentice will be able to describe keyless control stations and their applications.

Performance Indicators:

1. Describe digital keypad control stations.
2. Describe application of digital control stations.

Study Guide

- Read the goal and performance indicator for this package.
- Read the vocabulary list to find trade terms to be introduced in this package.
- Read technical content in introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Decoder
- Digital remote stations
- Field programmable
- Flush type
- Keyless stations
- Protective loop
- Surface mount
- Tamper proof

Introduction

The computer age has brought keyboard equipment for many purposes. This keyboard equipment ranges from computer terminals to simple push-button numbers on a key pad. Binary language allows numbers on a keyboard to be transmitted by dedicated lines or telephone lines to other locations. The 1 and 0 numbers of the binary language convert into opening and closing of switches.

Electronic locks can be operated from near or far by punching a set of numbers on a key pad. This allows combinations of code numbers to be used in the locking of doors, arming of systems and thousands of other applications.

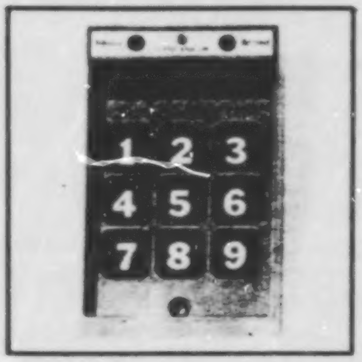
The big advantage of keyless stations over key stations is the ease with which combinations can be changed. The operator can stay ahead of a burglar by changing the conbinations for the alarm systems.

Information

Digital Remote Stations

The digital control systems are becoming common to the security alarm field. Digital systems are used as remote controls to arm a system and to monitor the status of the protective loop.

Digital controls are available in many shapes and sizes. Some high security models have up to 60,000 possible combinations on a 12-key keypad! These units are field programmable and tamper-proof. The model shown below has both off-on and shunt switch applications.



MODEL 7330/7340 DIGITAL KEY SYSTEM

- High Security — 59,000 combinations
- Field programmable in minutes
- Economical — up to ten 7330's on a single 7340
- "Touch" key operation
- Tamper-proof
- For ON/OFF or shunt-switch application
- Sealed vinyl touch-key pad for long trouble-free service
- Operates electric door strikes

Digital remote stations are packaged as a keyboard and decoder module or as self-contained units. A multiple station control with two types of keypads and a decoder module are shown below.

Information

A self-contained unit with either surface mount and flush type keyboards are shown below. These units do not require an encoder module.

Telsar
1
2
3
4
5
6
7
8
9

Digital remote stations may be wired with "two wire" or "four wire" runs. Most stations have red and green LED status lights. The power requirement is either 6 or 12 volt DC.

Most keyless stations have tamper-proof features to prevent attempts to decode the system. Some models use a remote master module to insure against tampering.

Each manufacturer will have special features for their control stations. The installer must select the keyless station that best fits the needs of a job.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check answers.

Job Sheet

USE KEYLESS KEY STATION

- Ask a journeyman installer to explain the use of a keypad control station.
- Get permission to arm and disarm the system by punching in the combination numbers.
- Ask them to show you how to change combinations.
- Determine the following about the unit.
  - Meaning of status lights (LED's)
  - Is it a 2 or 4 wire system?
  - What tamper protection is provided?
  - How many remote stations are on the system?
  - Is it a self-contained unit?
  - Are the key pads surface mounted or flush types?
  - What is the power requirement?
  - How many combinations does the unit provide?

Self Assessment

1. How many keys are usually found on a remote station keypad?

2. High security keypads can provide up to __________ combinations.

3. Remote stations are packaged in two forms. What are the forms?

4. Keypads are mounted in two ways. What are the ways?

5. Why should stations be tamper-proofed?

Self Assessment Answers

1. 12

2. 60,000

3. Self-contained units and with separate keypad and decoder modules.

4. Surface mount and flush type.

5. To prevent intruders from decoding the system.

•Post Assessment

1. What colors are the status lights on remote stations?

2. Remote stations are wired with __________ and __________ wire runs.

3. Remote master modules help insure against ____________ with the control station.

4. What are the functions of a digital remote station?

5. Keypads may be purchased with surface mount or __________ type keys.

Instructor Post Assessment Answers

1. Red and green

2. 2 and 4 wire runs

3. Tampering

4. Arm the system and monitor status of protective loop.

5. Flush

Supplementary References

- *Security Distributing and Marketing Magazine*. P.O. Box 272. Culver City, CA. 90230 (Past issues).

INSTRUCTIONAL LEARNING SYSTEMS

17.3

TYPES OF ANNUNCIATION

Goal:

The apprentice will be able to describe types of annunciation.

Performance Indicators:

1. Describe audible annunciation.
2. Describe visual annunciation.
3. Describe mechanical annunciation.
4. Describe applications of annunciation.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list.
- Study the introduction and information sheets.
- The job sheet has been deleted from this package. However, if you have an opportunity for getting some "hands on" experience with the various types of annunciators, please take advantage of the chance to learn.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Annunciation
- Audible annunciation
- Light emitting diodes (LED)
- Mechanical annunciation
- Strobe light
- Visual annunciation

Introduction

After the detection devices have done their job and have signaled the alarm, someone must be notified of the alarm condition. The alarm message must reach those that can respond to the alarm. That message can be sent by audible, visual or mechanical forms of annunciation.

The choices of annunciators are many. An installer should select annunciators that will get the attention of those that are likely to respond to the alarm. In some cases, the annunciation is intended to scare the burglar away from the protected area.

An installer should understand the purpose of annunciation and the types of annunciators to use in the different alarm systems.

Information

ANNUNCIATION

Annunciation is the way an alarm condition is expressed. It may be audible with ringing bells, buzzing buzzers, horns, beeps or chimes. Another form of annunciation is visual. Visual annunciation is usually a light such as that in LED indicators or a strobe light on a police car. Floodlights and spotlights may also be used to annunciate and alarm. If we set a "deadfall" for a burglar that causes a 200 pound weight to fall on him, that would be a form of mechanical annunciation. Mechanical annunciation is used in vehicle security. The fuel is shut off and the brakes lock up when the alarm is triggered.

AUDIBLE ANNUNCIATION

Control stations have built-in audible panic alarms. Many of them have a pre-alarm buzzer or sounder that gives an audible warning that an alarm is about to take place.

VISUAL ANNUNCIATION

Each control unit has at least two status lights. These status lights are operated by light emitting diodes (LED's). A green LED annunciates that the system is armed. The red (LED) annunciates the status of the protected loop.

MECHANICAL ANNUNCIATION

Control units can be programmed to operate door strikes. In many fire alarm systems, the alarm uses mechanical annunciation to close the doors and ventilation ducts to slow down a fire. Security systems in correctional facilities might annunciate an alarm by locking all cell block doors. Each cell block could be a zone of a multiple zone system.

APPLICATIONS OF ANNUNCIATORS

Each type of alarm system uses their own form of annunciation. Fire alarms are annunciated with loud shrill sirens and flashing strobe lights. A hold-up alarm must be silently annunciated because a nervous bandit might shoot their victim if an alarm was audibly annunciated. Homeowners may prefer local annunciation of a burglar alarm with flood lights and buzzers. This type of annunciation will frighten the burglar away from the property.

In relation to arming and zoning a system, the LED status lights are essential for the system. The pre-alarm buzzer is helpful in alerting people that an alarm condition is on the way.

Assignment

- Complete self assessment and check your answers.
- Complete post assessment, have instructor check answers.

Self Assessment

1. Give three examples of audible annunciation.

2. Give two examples of visual annunciation.

3. Give two examples of mechanical annunciation.

4. What types of annunciation is used in hold-up alarm systems?

5. What types of annunciation is used in fire alarm systems?

Self Assessment Answers

1. Bells, buzzers, sirens, beepers.

2. Strobe lights, LED's, floodlights, spotlights.

3. Brake lock mechanism, fuel shut-off.

4. Silent annunciation to avoid injury to hold-up victims.

5. Loud audible annunciation and attention getting visual annunciation such as strobe lights.

Post Assessment

What type of annunciation is represented by the following:

1. Siren
2. Floodlight
3. Fuel shut-off in automobile
4. Beeper
5. LED
6. Buzzer
7. Brake lock mechanism
8. Strobe light
9. Bell
10. Spotlight

Instructor Post Assessment Answers

1. Audible

2. Visual

3. Mechanical

4. Audible

5. Visual

6. Audible

7. Mechanical

8. Visual

9. Audible

10. Visual

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. 97230 (Past issues)

INSTRUCTIONAL LEARNING SYSTEMS

17.4

SHUNT SWITCHES

Goal:

The apprentice will be able to explain shunt switches and their application.

Performance Indicators:

1. Describe a shunt circuit.
2. Describe shunt switches.
3. Describe application of shunt switches.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list of trade terms that will be introduced in this package.
- Read the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Armature
- Break contact
- Coil
- Electromagnet
- Make contact
- NC contact
- NO contact
- Relay
- Shunt switch

Introduction

Owners of security alarm systems often have some problems in entering and leaving their premises without tripping the system. Many times they forget that the system is armed. This can be a source of embarrassment when police converge upon a person for entering their own business or home.

The shunt switch allows one part of the system to be removed from action while an entry is made. Once inside, the owner can disarm the system during the work day. When the owner leaves, the shunt will allow them to exit without alarming the system. Once outside the entire system can be secured for the night.

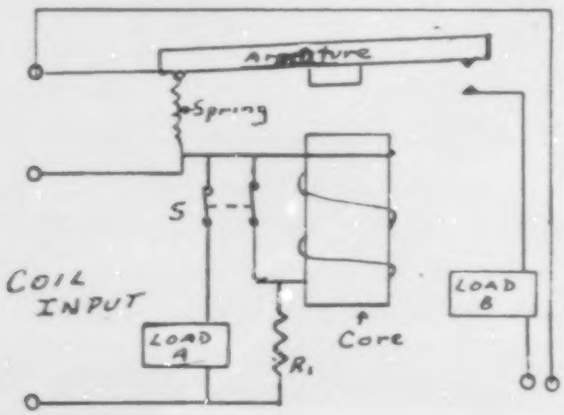
The installer should be knowledgeable about shunt circuits and their applications in alarm systems.

Information

Shunt Switches

The shunt switch is mounted near the door. It bypasses the door contact so that the owner will not set off their own alarm when they enter the building. This allows the owner to enter and turn off the system.

A shunt circuit uses a relay to bypass the door contact. A shunt control circuit is shown in the following diagram.



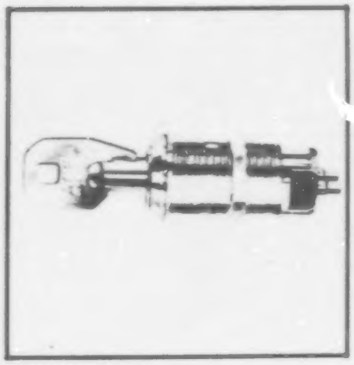
When switch S is opened, circuit A is deenergized and the shunt is removed from the relay coil. This allows the shunt to become energized and closes circuit B. Closing switch S reenergizes circuit A and shunts the coil. The deenergized coil releases the closed contacts which opens circuit B. A relay is an electromechanical device. It consists of a switch mechanism and an electromagnet. The relay has a hinged armature that allows it to move when attracted by the coil. One contact is mounted on the armature. When current is passed through the coil, it becomes magnetized and attracts the armature. This attraction closes the contacts. When the coil circuit is opened, the coil deenergizes the electromagnet and the contacts are opened.

Information

Design of Shunt Switches

The contact that is attached to the armature is called the NC contact or "break" contact. The NO contact is called the "make" contact. Switch locks are often used in shunt switches. When purchasing switch locks, read the specifications to find which positions will allow removal of the key. Some locks will show that the key can be removed in the make or break position. In other switch locks, the key can only be removed in the break position.

Switch locks are designed for use as on/off switches and as shunt switches. A standard switch lock with both on/off and shunt control is pictured below.



Shunt switches may be either SPDT or DPDT switches.

Applications

Some systems use control switches and shunt switches that are keyed alike. This allows the owner to activate the shunt and shut off the total system with a single key. Many silent alarm systems do not use shunts. When the business is opened in the morning an alarm is transmitted to the central station. If the central station expects this alarm at a certain time, it can be ignored. This procedure requires that the owner open and close at regular times.

Relays are being replaced with solid state devices in control systems. They are still being used in some inexpensive units. The more expensive units use transistors and integrated circuits for arming and zoning a system. Solid state devices require less space and use less stand-by power than relays.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and check answers.

Job Sheet

EXAMINE SHUNT SWITCHES

- Collect several shunt switches.
- Examine the switches closely.
- Determine:
    - Are switches SPDT or DPDT?
    - How do they attach to circuit wiring?
    - How many positions will allow removal of the key?
- Question a journeyman installer about the applications for shunt switches.
    - When should shunts be installed?
    - How are shunts installed?
    - What are the alternatives to shunts?

Self Assessment

1. What is the purpose of a shunt switch?

2. Where should it be located?

3. List the parts of a relay shunt circuit?

4. The NC contact is known as the __________ contact.

5. The NO contact is known as the ____________ contact.

Self Assessment Answers

1. Allows owners to enter building without tripping their own alarm. Shuts down that part of system near the door.

2. Near the door.

3. Electromagnet, switch mechanism and armature.

4. Break

5. Make

Post Assessment

1. A shunt circuit uses a ______________ to bypass the door circuit of an alarm system.

2. What is another name for the NO contact?

3. What is another name for the NC contact?

4. Relays are being replaced with ___________ ______________ devices in controls for alarm systems.

5. Relay contacts __________________ when the electromagnet is deenergized.
open, close

Instructor Post Assessment Answers

1. Relay

2. Make

3. Break

4. Solid state

5. Open

Supplementary References

- Driscoll, Edward F. *Industrial Electronics: Devices, Circuits and Applications*. American Technical Publishers, Inc. Alsip, Illinois. 1976

INSTRUCTIONAL LEARNING SYSTEMS

18.1

RED TAPE PROCEDURES

Goal:

The apprentice will be able to describe the "red tape" procedures of the security alarm business.

Performance Indicators:

1. Describe registration.
2. Describe licensing.
3. Describe NFPA regulations.
4. Describe UBC regulations.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Builder Board
- Building Code Division
- Department of Commerce
- Low Voltage/Limited Energy License
- National Electric Code
- NFPA regualtions
- Uniform Building Code

Introduction

Alarm system installers must adhere to the rules and regulations of several boards, agencies and codes that have been prescribed at the local, state and federal levels.

Basically, the fire codes of the National Fire Protection Association and the National Electrical Codes provide the framework for all rules and regulations for alarm installers. The State of Oregon and local governments interpret the national codes through state laws and administrative rules. Interpretations may differ by locality.

This maze of rules and regulations are sometimes confusing to those that must struggle with the red tape. An installer should understand how to register with the Builder Board; the licensing process; and the requirements of relevant sections of the Uniform Building Code (UBC) and National Fire Protection Association (NFPA) regulations. A check with the local fire marshal and building inspector will define how state and national regulations are interpreted locally.

Information

The installer will be faced with many regulations that influence the installation of alarm systems. Basically, the National Electric Code and the Uniform Building Code provide a framework for the rules and regulations. Enforcement of the rules and regualtions will vary from one locality to another.

The installer should be knowledgeable about the rules of the trade. Some of the rules that must be adhered to are:

- Registration with the Builder Board of the Department of Commerce. In order to register, applicant must have surety bonding and insurance coverage. The Builder Board requirements are specified in a separate package.
- Licensing must be obtained from the Building Codes Division of the Department of Commerce. Installers must have a Low Voltage/Limited Energy License which requires four years of work experience or apprenticeship training. Licensing will be discussed in a separate package.
- NFPA regulations must be followed in the installation of fire protection devices. These rules are administered by the state fire marshall office and local fire marshalls. The NFPA regulations fill 16 volumes. All regulations of interest to security alarm installers can be found in volumes 6 and 7. Individual pamphlets of these regulations that are specific to security alarms are:
  - #70 National Electric Code
  - #71 Central Receiving Stations
  - #72 Detection Equipment
- Uniform Building Code requirements must be adhered to by the installer. The UBC is cross-referenced to the NFPA regualtions. The particular sections of the UBC that should be reviewed by installers are:
  - Chapter 38
  - Chapter 12 (Section 10a)

  Local building inspectors are a good resource for questions about code requirements. These codes are administered statewide by the Building Codes Division of the Department of Commerce.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

REVIEW NFPA AND UBC

- Visit the local library and check out the NFPA and UBC codes. (In case the library does not have copies, contact the local building inspector and fire marshall.)
- Review Chapter 38 and Chapter 12 (Section 10a) of Uniform Building Code.
- Read pamphlets #70, #71 and #72 of NFPA regualtions.

Self Assessment

1. What two things are required for registration of an alarm business.

2. Who licenses alarm low voltage installers?

3. Who registers businesses?

4. Who administers the NFPA regulations at the state level? Local Level?

5. Who administers the UBC codes at the state level? Local level?

Self Assessment Answers

1. Bonding and insurance

2. Building Codes Division of Department of Commerce

3. Builder Board of Department of Commerce

4. State fire marshal; Local fire marshal

5. Building Codes Division; Building inspector

Post Assessment

Match the following terms and phrases.

_____	1. Building Codes Division	A. Administered by fire marshals.
_____	2. Builder Board	B. Licenses low voltage installers.
_____	3. NFPA regulations	C. Registers security alarm businesses.
_____	4. UBC codes	D. Requires bonding and insurance.
_____	5. Registration	E. Administered by Building Codes Division and local building inspectors.

Instructor Post Assessment Answers

B 1.

C 2.

A 3.

E 4.

D 5.

Supplementary References

- Registration

  Builders Board
  403 Labor and Industries Building
  Salem, Oregon 97310
  Telephone: 378-4621

- Licensing

  Building Codes Division
  401 Labor and Industries Building
  Salem, Oregon 97310
  Telephone: 378-4046

- NFPA Regulations

  Office of State Fire Marshal
  103 Labor and Industries Building
  Salem, Oregon 97310
  Telephone: 378-4917

  Local Fire Marshal

- UBC Codes

  Building Codes Division
  401 Labor and Industries Building
  Salem, Oregon 97310
  Telephone: 378-4046

  Local Building Inspector

INSTRUCTIONAL LEARNING SYSTEMS

19.1

BUILDER BOARD REQUIREMENTS

Goal:

The apprentice will be able to describe the requirements of the Builders Board for registration of business, bonding and insurance.

Performance Indicators:

1. Describe Oregon Administrative Rules (OAR) that apply to low voltage installers.
2. Describe Oregon Revised Statutes that apply to low voltage installers.
3. Describe procedure for registering with Department of Commerce.
4. Describe bonding requirements.
5. Describe insurance requirements.

Study Guide

- Read through the Oregon Administrative Rules. Use a highlighting pen to mark those OAR's that are relevant to installers.
- Read the Oregon Revised Statutes and highlight relevant parts.
- Study the instructions for registration.
- Study the form for obtaining a surety bond.
- Complete the job sheet.
- Complete the self assessment.
- Complete the post assessment.

Vocabulary

- Builder
- Builder Board
- Department of Commerce
- Liability insurance
- Lien
- Oregon Administrative Rule (OAR)
- Oregon Homebuilders Law
- Oregon Lien Law
- Oregon Lien Law
- Oregon Revised Statute (ORS)
- Personal injury insurance
- Property damage insurance
- Statutory lien
- Surety Bond

Introduction

Security alarm businesses are subject to the rules and statutes that govern the Builders Board of the Oregon Department of Commerce. All people that construct, repair or make installations in buildings fall under the rules and regulations. These rules and regulations require bonding, insurance and business registration for those that advertise to do work in residential and commercial settings.

The Department of Commerce has staff to interpret the administrative rules and Oregon Statutes to people in the trades. This package describes the requirements of Oregon laws that govern the Builders Board. A security alarm installer should study the rules and statutes and determine their own level of responsibility to the Department of Commerce.

An Oregon Revised Statute (ORS) is a state law. The Oregon Administrative Rules (OAR) are the operational rules that have been defined from the statutes. For operational purposes the OAR's are just as binding as the ORS's.

Information

Alarm system installers are subject to the bonding and insurance requirements of the Builders Board, Oregon Department of Commerce. Chapter 812 of the Oregon Administrative Rules (OAR) explains the rules that govern the Builders Board. A copy of OAR 812 is included in the information sheets of this package. The issues of registration, bonding and insurance are covered in that document. Another set of regulations are set forth in the Oregon Revised Statutes (ORS). The Oregon Homebuilders Law is found in Chapter 701 of the Oregon Revised Statutes. Chapter 87 of the Oregon Revised Statutes sets forth the Oregon Lien Law as it applies to those under the jurisdiction of the Builders' Board. A copy of ORS 701 and Excerpts from ORS 87 are included in the information sheets.

An installer must register with the Department of Commerce and obtain bonding and insuracne. The following information is taken directly from their registration packet. The packet answers questions and includes an application form. A copy of the Department of Commerce form for a surety bond is included. They require that this form be used in bonding and registration with the Builders' Board.

ORS CHAPTER 701

(OREGON HOMEBUILDERS LAW)

and excerpts from

ORS CHAPTER 87

(OREGON LIEN LAW)

BUILDERS BOARD
403 Labor & Industries Building
Salem, Oregon 97310

403-378-4621

GENERAL PROVISIONS

701.005 Definitions. As used in this chapter:

(1) "Board" means the Builders Board.

(2) "Builder" means a person who, in the pursuit of an independent business, undertakes or offers to undertake or submits a bid, or for compensation and with the intent to sell the structure arranges to construct, alter, repair, improve, move over public highways, roads or streets or demolish a structure, and the appurtenances thereto. "Builder" includes, but is not limited to:

(a) A person who purchases or owns property and constructs or for compensation arranges for the construction of one or more structures with the intent of selling the structure or structures;

(b) A school district, as defined in ORS 332.002, that permits students to construct a structure as an educational experience to learn building techniques and, upon completion of the structure, the district sells the completed structure; or

(c) A community college district, as defined in ORS 341.005, that permits students to construct a structure as an educational experience to learn building techniques and upon completion of the structure, the district sells the completed structure.

(3) If a builder is registered for residential work only, "structure" means a residence, including a site-built home, a modular home constructed off-site, a condominium and a mobile home, a duplex or multiunit residential building consisting of four units or less. If a builder has extended registration to include work performed on buildings of all types as provided in ORS 701.060, "structure" means all types of buildings, regardless of use.

701.010. Application. The following persons are exempt from registration under this chapter:

(1) A person who is constructing, altering, improving or repairing perso[illegible] property.

(2) A person who is constructing, altering, improving or repairing a structure located within the boundaries of any site or reservation under the jurisdiction of the Federal Government.

(3) A person who furnishes materials, supplies, equipment or finished product and does not fabricate them into, or consume them, in the performance of the work of a builder.

(4) A person working on one structure or project, under one or more contracts, when the aggregate price of all of that person's contracts for labor, materials and all other items is less than $500 and such work is of a casual, minor or inconsequential nature. This subsection does not apply to a person who advertises or puts out any sign or card or other device which might indicate to the public that that person is a builder.

(5) An owner who contracts for work to be performed by a registered builder. This subsection does not apply to a person who constructs or for compensation and with the intent to sell the structure, arranges to have constructed a structure with the intent of offering the structure for sale before,upon or after completion. It shall be prima facie evidence that there was an intent of offering the structure for sale if the person who constructed the structure does not occupy the structure after its completion.

(6) A person performing work on a property that person owns, whether occupied by that person or not, or a person performing work on that person's residence, whether or not that person owns the residence. This subsection does not apply to a person performing work on

a structure owned by that person if such work is performed, in the pursuit of an independent business, with the intent of offering the structure for sale before, upon or after completion.

(7) A person licensed in one of the following trades or professions when operating within the scope of that license:

(a) An architect licensed by the State Board of Architect Examiners.

(b) A registered professional engineer licensed by the State Board of Engineering Examiners.

(c) A water well contractor licensed by the Water Resources Department.

(d) A sewage disposal system installer licensed by the Department of Environmental Quality.

(e) A landscaping business licensed under ORS 671.510 to 671.710 that constructs fences, decks, walkways or retaining walls only when done in conjunction with landscaping work.

(8) A person who performs work subject to this chapter as an employe of a builder.

(9) A manufacturer of a mobile home constructed under standards established by the Federal Government.

(10) A person involved in the movement of:

(a) Modular buildings or structures other than mobile homes not in excess of 14 feet in width.

(b) Structures not in excess of 16 feet in width when they are beingmoved by their owner if such owner is not a builder required to be registered under this chapter.

(11) A commercial lending institution that arranges for the completion, repair or remodeling of a structure. As used in this subsection, "commercial lending institution" means any bank, mortgage banking company, trust company, savings bank, savings and loan association, credit union, national banking association, federal savings and loan association, insurance company or federal credit union maintaining an office in this state.

REGISTRATION

701.055 Registration required of builder; issuance of building permits to unregistered builders prohibited; evidence of activity as builder; duty of contractor to supply subcontractor registration number. (1) A person shall not undertake, offer to undertake or submit a bid to do work as a builder on a residential structure unless that person has a current, valid certificate of registration for residential work issued by the board. A partnership, corporation or joint venture may do such work, offer to undertake such work or submit a bid to do such work only if that partnership, corporation or joint venture is registered for residential work.

(2) A registered partnership or corporation shall notify the board immediately upon any change in partners or corporate officers. Upon a change in partners, a registered partnership immediately shall register again and pay to the board the fee required by ORS 701.125 for an original registration.

(3) A city, county or the State of Oregon shall not issue a building permit to anyone required to be registered under this chapter who does not have a current, valid certificate of registration. Each county, city or the State of Oregon which requires the issuance of a permit as a condition precedent to construction, alteration, improvement, demolition, movement or repair of any building or structure or the appurtenances to the structure shall also require that each applicant for such permit file as a condition to issuing the permit a written statement, subscribed by the applicant, that the applicant is registered under the

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provisions of this chapter, giving the number of the registration and stating that the registration is in full force and effect, or, if the applicant is exempt from the provisions of this chapter, listing the basis for the exemption. The city, county or the State of Oregon shall list the builder's registration number on the permit obtained by that builder.

(4) Every city and county which requires the issuance of a business license as a condition precedent to engaging, within the city or city and county, in a business which is subject to regulation under this chapter, shall require that each licensee and each applicant for issuance or renewal of such license file, or have on file, with such city or city and county, a signed statement that such licensee or applicant is registered under the provisions of this chapter and stating that the registration is in full force and effect.

(5) It shall be prima facie evidence of doing business as a builder when a person for that person's own use performs, employs others to perform, or for compensation and with the intent to sell the structure, arranges to have performed any work described in ORS 701.005(2) if within any one 12-month period that person offers for sale two or more structures on which that work was performed.

(6) Registration under this chapter is prima facie evidence that the registrant conducts a separate, independent business.

(7) The provisions of this chapter shall be exclusive and no city, county or other political subdivision shall require or issue any registrations, licenses or surety bonds, nor charge any fee for the regulatory or surety registration of any builder registered with the board. However, nothing in this subsection shall limit or abridge the authority of any city or county to license and levy and collect a general and nondiscriminatory license fee levied upon all businesses, or to levy a tax based upon business conducted by any firm within said jurisdiction, or to limit the authority of any city or county with respect to builders not required to be registered under this chapter.

(8)(a) Every builder shall maintain a list which includes the following information about all subcontractors or other builders performing work on a residential structure for that builder.

(A) Names and addresses

(B) Registration numbers

(b) The list referred to in paragraph (a) of this subsection shall be delivered to the board within 24 hours after a request made during reasonable working hours.

(9) A builder, including but not limited to a general contractor, shall not hire any subcontractor or other builder to work on a residential structure unless the subcontractor or builder is registered under this chapter or exempt from registration under the provisions of ORS 701.010.

(10) A summary of this chapter, prepared by the board and provided at cost to all registered builders, shall be delivered by the builder to the owner when the builder begins work on a structure.

701.060 Registration may apply to nonresidential buildings. (1) Any builder registered under this chapter may at the time of registration or renewal and at no additional fee include registration for activities performed by the builder in the construction, alteration, improvement, moving over public highways, roads or streets, demolition and repair of buildings of all types.

(2) If a builder makes application for registration pursuant to subsection (1) of this section all construction, alteration, improvement, moving over public highways, roads or streets, demolition or

repair performed by that builder on buildings of all types shall be subject to the provisions of this chapter and to regulation by the board. Such registration shall be exclusive as provided in ORS 701.055(7).

701.065 Registration required to maintain court suit or action for performance of work or file a lien. (1) A builder may not file a lien, file a claim with the Builders Board or bring or maintain in any court of this state a suit or action for compensation for the performance of any work on a residential structure or for breach of any contract for work on a residential structure which is subject to this chapter, unless the builder was:

(a) Registered under this chapter at the time the builder bid or entered into the contract for performance of the work; and

(b) Registered continuously while performing the work for which compensation is sought.

(2) A court may choose not to apply this section if the court finds that to do so would result in a substantial injustice to the unregistered builder.

701.075 Registration application. A person who wishes to register as a builder shall submit an application, under oath, upon a form prescribed by the board. The application shall include the following information regarding the applicant:

(1) Social security number.

(2) Workers' compensation insurance account number if help is hired or traded.

(3) Unemployment insurance account number if help is hired.

(4) State withholding tax account number if help is hired.

(5) Federal employer identification number, if help is hired or if self-employed and participating in a retirement plan.

(6) The name and address of:

(a) Each partner or venturer, if the applicant is a partnership or joint venture.

(b) The owner, if the applicant is an individual proprietorship.

(c) The corporate officers, if the applicant is a corporation.

701.080 Builder to notify board of address change; effect of mail to last known address. (1) It shall be the duty of a builder to notify the board of any change of address while registered and for one year following the date the builder's registration expires or otherwise becomes inactive. The builder shall so notify the board within 10 days of the date upon which the change of address occurs. Any proposed or final order or notice of hearing directed by the board to the last-known address of record shall be considered delivered when deposited in the United States mail and sent registered or certified or post office receipt secured. Any other communication directed by the board to the last-known address of record shall be considered delivered when deposited in the United States mail, regular mail.

701.085 Surety bond required of builders; conditions of bond; suspension or denial of certificate when bond liability exceeded. (1) A person who wishes to register as a builder or renew a certificate of registration shall file with the board a surety bond with one or more corporate sureties authorized to do business in this state in the amount of $5,000, conditioned that the applicant, with regard to work subject to this chapter, will pay claims ordered paid by the board under ORS 701.140. Bonds filed under this subsection shall become effective on the date the builder meets

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all requirements for registration or renewal and shall remain in effect for one year from that date or until depleted by claims paid under ORS 701.140, unless the surety sooner cancels the bond. At the discretion of the surety the bond may be continued for an additional period by continuation certificate. The aggregate liability of the surety under the bond for claims against the bond shall not exceed the penal sum of the bond. No extension by continuation certificate, reinstatement, reissue or renewal of the bond shall increase the liability of the surety.

(2) The board may reduce the amount of the surety bond required by this section to $2,000 for a registrant upon a showing that the registrant did not perform work on structures exceeding $30,000 in gross volume during the previous 12-month period in which the registrant was registered.

(3) If the amount the registrant must pay against the bond under this section exceeds the amount of the bond, the board shall suspend the certificate of the registrant until the amount owed is paid. The board, as a condition of ending the suspension, may require the registrant to file a bond of an amount three times as much as the amount required ordinarily of a registrant under this section.

(4) An applicant for registration or renewal, who has an outstanding final judgment by a court against the applicant that a bond under this section would have been subject to, shall not be permitted to register or renew a registration until the judgment is satisfied. The board, as a condition of registering the applicant, may require the applicant to file a bond of an amount three times as much as the amount required ordinarily of an applicant under this section.

(5) The bond required under this section is for the exclusive purpose of payment of final orders of the board in accordance with this chapter.

(6) Upon determination of a claim under ORS 701.140 against a builder who holds a bond required under this section the board shall notify the surety on the bond of the final order in a manner determined by the board by rule. The notification shall include a list of all claims upon which a final order has been issued.

(7) No suit or action may be commenced against a surety on a bond required under this section until 30 days after the date that the surety is notified by the board under ORS 701.140 that payment is due on the claim.

(8) In any action against a surety on a bond under this section that is based on the failure of the surety to pay a claim or on the denial of a claim by the surety, the court may award:

(a) Costs;

(b) Reasonable attorney fees to the prevailing party as part of the costs; and

(c) If the surety is ordered to pay a claim on the bond that the surety arbitrarily and capriciously refused to pay upon order of the board, twice the amount of damages against the surety as ordered by the board.

701.095 Deposit in lieu of bond. (1) In lieu of the surety bond required by ORS 701.085, the builder may file with the board, under the same terms and conditions as when a bond is filed, a deposit in cash or negotiable securities of a character approved by the State Treasurer. Negotiable securities may be deposited in a bank or trust company in a manner authorized by the State Treasurer.

(2) Any securities of the Federal Government that have an immediate market value in excess of the bond amount are an acceptable deposit under this section. The bank or trust company may substitute other securites that meet

the requirements of this section for the securities of the Federal Government initially deposited.

701.105 Insurance required of builders; notice of cancellation. (1) Throughout the period of registration the builder shall have in effect public liability and property damage insurance covering the work of that builder which is subject to this chapter in not less than the following amounts:
(a) $25,000 injury or damage to property
(b) $50,000 for injury or damage including death to any one person; and
(c) $100,000 for injury or damage including death to more than one person.
(2) The builder shall provide satisfactory evidence to the board at the time of registration and renewal that the insurance required by subsection (1) of this section has been procured and is in effect.

701.115 Term of registration; renewal; registration identification card. (1) A certificate of registration is valid for one year from the date of issuance unless the registration is revoked or suspended as set forth in ORS 701.135. It may be renewed by the same procedure provided for an original registration upon application and furnishing of any additional supplemental information as the board may require by rule.
(2) The board shall issue a pocket-card certificate of registration to a builder registered under this chapter.
(3) The board may vary the dates of registration renewal by giving to the registrant written notice of the renewal date assigned and by making appropriate adjustments in the renewal fee.

701.125 Registration fee. (1) Each applicant shall pay to the board:

(a) For original registration or renewal of registration, a fee as determined by the board under ORS 701.130.

(b) A fee for all changes in the registration, as prescribed by the board, other than those due to clerical errors.

(2) The board shall set the fees referredto in subsection (1) of this section so that the moneys received are adequate to administer the provisions of this chapter pursuant to ORS 701.130.

701.130 How registration fee determined. (1) On or after June 1 of each year, but before July 1, the board shall determine the amount of the fee an applicant must pay for original builder registration or renewal of builder registration under ORS 701.125. The fees shall be subject to the review of the Executive Deparwtment and the prior approval of the appropriate legislative review agency. The fees and charges established under this section shall not exceed the cost of administering the regulatory program of the board pertaining to the purpose for which the fee or charge is established, as authorized by the Legislative Assembly for the board's budget, as modified by the Emergency Board or future sessions of the Legislative Assembly.

(2) The amount of the fee determined by the board under subsection (1) of this section shall be effective for a 12-month period beginning on July 1 of each year.

701.135 Grounds for discipline; injunctions. (1) The board may revoke, suspend or refuse to issue or reissue a certificate of registration if the board determines after notice and opportunity for hearing:

(a) That the registrant or applicant has violated ORS 701.055.

(b) That the registrant or applicant has failed to pay in full any final judgment on claims adjudged by the board or by a court of competent jurisdiction referred to in ORS 701.085.

(c) That the insurance required by ORS 701.105 is not currently in effect.

(d) That the surety bond or deposit required by ORS 701.085 and 701.095 are not currently in effect.

(e) That the registrant or applicant has engaged in conduct as a builder that is dishonest or fraudulent that the board finds injurious to the welfare of the public.

(f) That the registrant has violated a rule or order of the board.

(g) That the registrant has knowingly assisted an unregistered person to act in violation of this chapter.

(h) That a lien was filed on a structure under ORS 87.010 to 87.060 and 87.075 to 87.088 because the registrant or applicant wrongfully failed to perform a contractual duty to pay money to the person claiming the lien.

(2) In addition to all other remedies, when it appears to the board that a person has engaged in, or is engaging in, any act, practice or transaction which violates the provisions of this chapter, the board may direct the Attorney General or the district attorney of the county in which the act, practice or transaction occurs, to apply to the court for an injunction restraining the person from violating the provisions of this chapter. An injunction shall not issue for failure to maintain the list provided for in ORS 701.055(8) unless the court determines that the failure is intentional.

CLAIMS

701.140 Types of allowable claims; procedure. The board shall only accept and make determinations of the following types of claims for damages against builders registered under this chapter. If upon final determination and order by the board a builder fails to pay a claim determined against the builder by the board, the board shall notify the surety that payment is due from the bond required under ORS 701.085. This section applies to the following types of claims:

(1) Claims against a builder by the owner of a structure for the following in performing any work subject to this chapter:

(a) Negligent work.

(b) Improper work.

(c) Breach of contract.

(2) Claims against a builder by the owner of a structure to discharge or to recoup funds expended in discharging a lien established under ORS 87.010 to 87.060 and 87.075 to 87.088 under circumstances described under this subsection. The board may reduce any amount adjudged by the board under this section by any amount the claimant owes the builder. The board shall only determine claims under this subsection if:

(a) The owner has paid the builder for that builder's work subject to this chapter; and

(b) A lien is filed against the structure of the owner under ORS 87.010 to 87.060 and 87.075 to 87.088 because the builder failed to pay the person claiming the lien for that person's contribution toward completion of the structure.

(3) Claims against a registered builder subcontractor by a registered contractor for the following in performing any work subject to this chapter:

(a) Negligent work;

(b) Improper work; or

(c) Breach of contract.

(4) Claims by persons furnishing labor or material or renting or supplying equipment to a builder.

(5) Claims against a builder by anyone who is injured as a result of the builder's failure to comply with the requirements of ORS 454.605 to 454.745 or rules adopted by the Environmental Quality Commission under ORS 454.625.

701.145 Procedure for making claims against builder; investigation by board; disciplinary action. (1) Any person having a claim against a builder of the type referred to in ORS 701.140, may file with the board a statement of the claim in such form as the board prescribes.

(2) The board may refuse to accept, or refuse at any time to continue processing, a claim if:

(a) The same facts and issues involved in the claim have been submitted to a court of competent jurisdiction for determination or have been submitted to any other entity authorized by law or the parties to effect a resolution and settlement;

(b) The claimant does not permit the builder against whom the claim is filed to be present at any inspection made by the board;

(c) The board determines that the builder against whom the claim is filed is capable of complying with recommendations made by the board relative to the claim, but the claimant does not permit the builder to comply with the recommendations. However, the board may refuse to accept or further process a claim under this paragraph only if the builder was registered at the time the work was first performed and is registered at the time the board makes its recommendations; or

(d) The board determines that the nature or complexity of the claim is such that a court is the appropriate forum for the adjudication of the claim.

(3) The board shall not process a claim unless it is filed in a time manner as follows:

(a) If the owner of a new structure files a claim, the board must receive the claim not later than one year after the date the structure was first occupied or two years after completion, whichever comes first.

(b) If the owner of an existing structure files the claim, the board must receive the claim not later than one year after the date the work was substantially completed.

(c) Regardless of whether the claim involves a new or existing structure, if the owner files the claim because the builder failed to begin the work, the board must receive the claim not later than one year after the date the parties entered into the contract.

(d) Regardless of whether the claim involves a new or existing structure, if the owner files the claim because the builder failed to substantially complete the work, the board must receive the claim not later than one year after the date the builder ceased work on the structure.

(e) If a registered general contractor files the claim against a registered subcontractor, the board must receive the claim not later than one year after the date the subcontractor performed the work.

(f) If a registered general contractor files the claim against a registered subcontractor, because the subcontractor failed to substantially complete the work, the board must receive the claim not later than one year after the date the subcontractor ceased to work on the structure.

(g) If a material or equipment supplier, an employe, or a registered subcontractor files the claim, the board must receive the claim not later than one year after the date the registrant incurred the indebtedness.

(4) Upon acceptance of the statement of claim, the board shall give notice to the builder against whom the claim is made and shall initiate proceedings to determine the validity of the claim. If, after investigation, the board determines that a violation of this chapter or of any rule promulgated thereunder has occurred, the board shall recommend to the registrant such action as the board considers appropriate to compensate the claimant for any damages incurred as the result of the violation. If the builder performs accordingly, the board shall give that fact due consideration in any subsequent disciplinary proceeding brought by the board.

701.150 Priority of satisfying claims from bond or deposit. If a final board order is not paid by the registrant, the board shall notify the surety on the bond. The claim shall be satisfied from the deposit or by the surety from the bond as follows:

(1) If the total claims filed with the board against a builder within 90 days after the date the board receives notice of the first claim against the builder exceed the amount of the bond or deposit, the bond or deposit shall be apportioned in proportion to the amount the board adjudges to be owed on each claim, subject to the priorities established under this section.

(2) Claims shall be satisfied from the bond or deposit in the following priority:

(a) Within any 90-day period, claims filed against a builder by the owner of a structure shall have payment priority to the full extent of the bond or deposit over all other types of claims.

(b) If claims filed against a builder by the owner of a structure do not exhaust the bond or deposit, then all other types of claims filed within that 90-day period may be satisfied from the bond or deposit, except that the total amount paid from any one bond or deposit [illegible] nonowner claimants shall not exceed $2,000.

(c) A subsequent 90-day period will begin on the date the first claim is filed after the close of each preceding 90-day period. Claims shall be satisfied from the bond or deposit in each 90-day period in the manner set forth in paragraphs (a) and (b) of this subsection.

(3) If the total claims filed with the board within 90 days after the first claim is filed do not exceed the amount of the bond or deposit, all claims filed within the 90-day period shall have priority over all claims subsequently filed until the amount of the bond or deposit is exhausted but not later than one year following the date of expiration of the certificate of registration in force at the time the work was completed.

BUILDERS BOARD

701.205 Builders Board; members; terms; confirmation; vacancies; qualifications.

(1) There is established within the Department of Commerce the Builders Board, consisting of five members appointed by the Governor subject to confirmation by the Senate in the manner provided by law. Three of the members shall be builders, including one builder engaged in the business of remodeling, one shall be a public member and one shall be an elected representative of governing bodies of local government.

(2) The term of office of each member is four years, but a member serves at the pleasure of the Governor. Before the expiration of the term of a member, the Governor shall appoint a successor whose

term begins on July 1 next following. A member is eligible for reappointment. If there is a vacancy for any cause, the Governor shall make an appointment immediately effective for the unexpired term.

(3) In order to be eligible for board membership, the three builder members of the board shall be registered under this chapter and shall maintain their registration in good order during their term of office.

701.215 Officers; quorum; compensation and expenses. (1) The board shall select from among its members a chairman, a vice chairman and such other officers for such terms and with such duties and powers necessary for the performance of their duties as the board determines.

(2) A majority of the members of the board constitutes a quorum for the transaction of business.

(3) A member of the board is entitled to compensation and expenses as provided in ORS 292.495.

701.225 Investigatory powers of board; use of city or county inspectors; conduct of hearings. (1) The board may investigate the activities of any person engaged in the building and construction industry to determine compliance with this chapter.

(2) With the approval of the city or county, the board may conduct investigations with city or county inspectors, provided that the city or county is reimbursed by the department for the costs of such investigations.

(3) The board has the power to administer oaths, issue notices and subpenas in the name of the board, compel the attendance of witnesses andthe production of evidence, hold hearings and perform such other acts as are reasonably necessary to carry out its duties under this chapter.

(4) If any person fails to comply with a subpena issued under subsection (3) of this section or refuses to testify on matters on which he may be lawful[illegible] interrogated, the board shall compe[illegible] obedience in the manner provided in ORS 183.440.

701.230 Board to provide names of unregistered builders to other state agencies. At least once each month, the board shall provide to investigative units of the Department of Revenue, Worker's Compensation Department and Employment Division the name and address of each person who acts as a builder in violation of this chapter or who knowingly assists an unregistered person to act in violation of this chapter.

701.235 Rulemaking authority. The board shall promulgate rules to carry out this chapter.

PENALTIES

701.990 Penalties. Violation of ORS 701.055(1) is a misdemeanor.

701.992 Civil penalties; enforcement. (1) Any person who violates any provision of this chapter or any rule promulgated thereunder shall forfeit and pay into the General Fund of the State Treasury a civil penalty in an amount determined by the board of not more than $1,000 for each offense.

(2) An order of the board imposing a civil penalty which becomes final by operation of law or on appeal and remains unpaid 10 days after the order becomes final shall constitute a judgment in favor of the board against the person and may be filed with the county clerk in any county of this state.

(3) Upon filing, the clerk shall docket the order in the judgment docket in the

same manner as a judgment of a court of record. After docketing, the order is equivalent to a judgment and is controlled by and subject to statutes relating to judgments.

(4) The provisions of this section are in addition to and not in lieu of any other penalty or sanction provided by law.

CONSTRUCTION LIENS

87.001 Short title. ORS 87.001 to 87.060 and 87.075 to 87.093 shall be known and may be cited as the Construction Lien Law. [1975 c.466 §1]

87.005 Definitions for ORS 87.001 to 87.060 and 87.075 to 87.093. As used in ORS 87.001 to 87.060 and 87.075 to 87.093:

(1) "Commencement of the improvement" means the first actual preparation or construction upon the site or the first delivery to the site of materials of such substantial character as to notify interested persons that preparation or construction upon the site has begun or is about to begin.

(2) "Construction" includes creation or making of an improvement, and alteration, partial construction and repairs done in and upon an improvement.

(3) "Construction agent" includes a contractor, architect, builder or other person having charge of construction or preparation.

(4) "Contractor" means a person who contracts on predetermined terms to be responsible for the performance of all or part of a job of preparation or construction in accordance with established specifications or plans, retaining in himself control of means, method and manner of accomplishing the desired result, and who provides:

(a) Labor at the site; or

(b) Materials, supplies and labor at the site.

(5) "Improvement" includes any building, wharf, bridge, ditch, flume, reservoir, well, tunnel, fence, street, sidewalk, machinery, aqueduct and all other structures and superstructures, whenever it can be made applicable thereto.

(6) "Mortgagee" means a person who has a valid subsisting mortgage of record or trust deed of record securing a loan upon land or an improvement.

(7) "Original contractor" means a contractor who has a contractual relationship with the owner.

(8) "Owner" means:

(a) A person who is or claims to be the owner in fee or a lesser estate of the land on which preparation or construction is performed; or

(b) A person who has entered into a contract for the purchase of an interest in the land or improvement thereon sought to be charged with a lien created under ORS 87.010; or

(c) A person to whom a valid subsisting lease on land or an improvement is made, and who possesses an interest in the land or improvement by reason of that lease.

(9) "Preparation" includes excavating, surveying, landscaping, demolition and detachment of existing structures, leveling, filling in, and other preparation of land for construction.

(10) "Site" means the land on which construction or preparation is performed.

(11) "Subcontractor" means a contractor who has no direct contractual relationship with the owner. [Amended by 1957 c.651 §1; 1973 c.671 §1; 1975 c.466 §2; 1977 c.596 §1]

87.010 Construction liens; who is entitled to lien. (1) Any person performing labor upon, transporting or furnishing any material to be used in, or renting equipment used in the construction of any improvement shall have a lien upon the improvement for the labor, transportation or material furnished or equipment rented at the instance of the owner of the improvement or his construction agent.

(2) Any person who engages in or rents equipment for the preparation of a lot or parcel of land, or improves or rents equipment for the improvement of a street or road adjoining a lot or parcel of land at the request of the owner of the lot or parcel, shall have a lien upon the land for work done, materials furnished or equipment rented.

(3) A lien for rented equipment under subsection (1) or (2) of this section shall be limited to the reasonable rental value of the equipment notwithstanding the terms of the underlying rental agreement.

(4) Trustees of an employe benefit plan shall have a lien upon the improvement for the amount of contributions, due to labor performed on that improvement, required to be paid by agreement or otherwise into a fund of the employe benefit plan.

(5) An architect, landscape architect, land surveyor or registered engineer who, at the request of the owner or an agent of the owner, prepares plans, drawings or specifications that are intended for use in or to facilitate the construction of an improvement or who supervises the construction shall have a lien upon the land and structures necessary for the use of the plans, drawings or specifications so provided or supervision performed.

(6) A landscape architect, land surveyor or other person who prepares plans, drawings, surveys or specifications that are used for the landscaping or preparation of a lot or parcel of land or who supervises the landscaping or preparation shall have a lien upon the land for the

plans, drawings, surveys or specifications used or supervision performed. [Amended by 1957 c.651 §2; 1973 c.671 §2; 1975 c.466 §3; 1977 c.596 §2; 1981 c.757 §1]

87.015 Land and interests therein subject to lien; leaseholds. (1) The site together with the land that may be required for the convenient use and occupation of the improvement constructed on the site, to be determined by the court at the time of the foreclosure of the lien, shall also be subject to the liens created under ORS 87.010 (1), (4) and (5) if, at the time of the commencement of the improvement, the person who caused the improvement to be constructed was the owner of that site and land. If the person owned less than a fee-simple estate in the site and land, then only his interest therein shall be subject to the lien.

(2) If a lien created under ORS 87.010 (1), (4) and (5) is claimed against a unit as defined in ORS 94.004 to 94.480, the Oregon Condominium Act, the common elements appertaining to that unit are also subject to the lien.

(3) When the interest of the person who caused the improvement to be constructed is a leasehold interest, and that person has forfeited his rights thereto, the purchaser of the improvement and leasehold term at any sale under the provisions of ORS 87.001 to 87.060 and 87.075 to 87.093, is deemed to be the assignee of the leasehold term, and may pay the lessor all arrears of rent or other money and costs due under the lease. If the lessor regains possession of the property, or obtains judgment for the possession thereof prior to the commencement of construction of the improvement, the purchaser may remove the improvement within 30 days after he purchases it, and the owner of the land shall receive the rent due him, payable out of the proceeds of the sale, according to the terms of the lease, down to the time of removal. [Amended by 1975 c.466 §4]

87.018 Delivery of notices. All notices required under ORS 87.001 to 87.060 and 87.075 to 87.093 shall be in writing and delivered in person or delivered by registered or certified mail except for the "Information Notice to Owner" described in ORS 87.093 which may also be proved by a United States Postal Service certificate of mailing. [1975 c.466 §5; 1981 c.757 §2]

Note: 87.018 was enacted into law by the Legislative Assembly but was not added to or made a part of 87.005 to 87.075 by legislative action. See Preface to Oregon Revised Statutes for further explanation.

87.020 [Amended by 1965 c.446 §1; 1967 c.600 §1; 1967 c.602 §1; repealed by 1975 c.466 §6 (87.021 enacted in lieu of 87.020)]

87.021 Notice to owners; effect of failure to give notice. (1) Except when material or labor described in ORS 87.010 (1) to (3), (5) and (6) is furnished at the request of the owner, a person furnishing any materials or labor described in ORS 87.010 (1) to (3), (5) and (6) for which a lien may be claimed under ORS 87.010 shall give a notice of the right to lien to the owner of the site. The notice of the right to lien may be given at any time during the progress of the improvement, but the notice only protects the right to claim a lien on those materials and that labor provided after a date which is eight days not including Saturdays, Sundays and other holidays as defined in ORS 187.010 before the notice is delivered or mailed. However, no right to claim a lien under ORS 87.010 (5) or (6) exists for any services provided for an owner-occupied residence at the request of an agent of the owner.

(2) The notice required by subsection (1) of this section shall be substantially in the form set forth in ORS 87.023.

(3) A lien claimed under ORS 87.010 (1) to (3), (5) or (6) shall not be enforced unless the notice required by subsection (1) of this section is given.

(4) A person who performs labor upon a commercial improvement or provides labor and material for a commercial improvement or who rents equipment used in the construction of a commercial improvement need not give the notice required by subsection (1) of this section in order to acquire a lien under ORS 87.010. As used in this subsection:

(a) "Commercial improvement" means any structure or building not used or intended to be used as a residential building, or other improvements to a site on which such a structure or building is to be located.

(b) "Residential building" means a building or structure that is or will be occupied by the owner as a residence and that contains not more than four units capable of being used as residences or homes. [1975 c.466 §7 (enacted in lieu of 87.020); 1981 c.757 §3; 1983 c.674 §1; 1983 c.757 §1]

87.023 Notice of right to lien; form of notice. The notice of the right to lien required under ORS 87.021 shall include, but not be limited to, the following information and shall be substantially in the following form:

NOTICE OF THE RIGHT TO LIEN WARNING: READ THIS NOTICE. PROTECT YOURSELF FROM PAYING ANY CONTRACTOR OR SUPPLIER TWICE FOR THE SAME SERVICE.

To: ____________ Date of mailing: ____________
Owner
____
Owner's address
____

This is to inform you that ________________ has begun to provide ________________ (description of materials, labor or services) ordered by ________________ for improvements to property you own. The property is located at ________________

A lien may be claimed for all materials, labor and services furnished after a date that is eight days not including Saturdays, Sundays and other holidays as defined in ORS 187.010 before this notice was mailed to you.

Even if you or your mortgage lender have made full payment to the contractor who ordered these materials or services, your property may still be subject to a lien unless the supplier providing this notice is paid.

THIS IS NOT A LIEN. It is a notice sent to you for your protection in compliance with the construction lien laws of the State of Oregon.

This notice has been sent to you by:

NAME:____________
ADDRESS:____________
TELEPHONE:____________

IF YOU HAVE ANY QUESTIONS ABOUT THIS NOTICE, FEEL FREE TO CALL US.

IMPORTANT INFORMATION ON REVERSE SIDE

IMPORTANT INFORMATION FOR YOUR PROTECTION

Under Oregon's laws, those who work on your property or provide materials and are not paid have a right to enforce their claim for payment against your property. This claim is known as a construction lien.

If your contractor fails to pay subcontractors, material suppliers or laborers or neglects to make other legally required payments, the people who are owed money can look to your property for payment, even if you have paid your contractor in full.

The law states that all people hired by a contractor to provide you with materials, labor or services must give you a notice of the right to lien to let you know what they have provided.

WAYS TO PROTECT YOURSELF ARE:

- RECOGNIZE that this notice of delivery of materials, labor or services may result in a lien against your property unless all those supplying a notice of the right to lien have been paid.

- LEARN more about the lien laws and the meaning of this notice by contacting the Builders Board, an attorney or the firm sending this notice.

- ASK for a statement of the labor or materials provided to your property from each party that sends you a notice of the right to lien.

- WHEN PAYING your contractor for materials, labor or services, you may make checks payable jointly to the contractor and the firm furnishing materials, labor or services for which you have received a notice of the right to lien.

- OR use one of the methods suggested by the "Information Notice to Owners." If you have not received such a notice, contact the Builders Board.

- GET EVIDENCE that all firms from whom you have received a notice of the right to lien have been paid or have waived the right to claim a lien against your property.

- CONSULT an attorney, a professional escrow company or your mortgage lender.

[1981 c.[illegible] §5; 1983 c.757 §2]

87.025 Priority of liens; right to sell improvements separately from land; notice to mortgagee; list of materials or supplies. (1) A lien created under ORS 87.010 (2) or (6) upon any lot or parcel of land shall be preferred to any lien, mortgage or other encumbrance which attached to the land after or was unrecorded at the time of commencement of the improvement.

(2) Except as provided in subsections (3) and (6) of this section, a lien created under ORS 87.010 (1), (4) or (5) upon any improvement

shall be preferred to all prior liens, mortgages or other encumbrances upon the land upon which the improvement was constructed. To enforce such lien the improvement may be sold separately from the land; and the purchaser may remove the improvement within a reasonable time thereafter, not to exceed 30 days, upon the payment to the owner of the land of a reasonable rent for its use from the date of its purchase to the time of removal. If such removal is prevented by legal proceedings, the 30 days shall not begin to run until the final determination of such proceedings in the court of first resort or the appellate court if appeal is taken.

(3) No lien for materials or supplies shall have priority over any recorded mortgage or trust deed on either the land or improvement unless the person furnishing the material or supplies, not later than eight days, not including Saturdays, Sundays and other holidays as defined in ORS 187.010, after the date of delivery of material or supplies for which a lien may be claimed, delivers to the mortgagee either a copy of the notice given to the owner under ORS 87.021 to protect the right to claim a lien on the material or supplies or a notice in any form that provides substantially the same information as the form set forth in ORS 87.023.

(4) A mortgagee who has received notice of delivery of materials or supplies in accordance with the provisions of subsection (3) of this section, may demand a list of those materials or supplies including a statement of the amount due by reason of delivery thereof. The list of materials or supplies shall be delivered to the mortgagee within 15 days of receipt of demand, as evidenced by a receipt or a receipt of delivery of a registered or certified letter containing the demand. Failure to furnish the list or the amount due by the person giving notice of delivery of the materials or supplies shall constitute a waiver of the preference provided in subsections (1) and (2) of this section.

(5) Upon payment and acceptance of the amount due to the supplier of materials or supplies, and upon demand of the person making payment, the supplier shall execute a waiver of all lien rights as to materials or supplies for which payment has been made.

(6) Unless the mortgage or trust deed is given to secure a loan made to finance the alteration or repair, a lien claimed under ORS 87.010 for the alteration and repair of an improvement commenced and made subsequent to the date of record of a duly executed and recorded mortgage or trust deed on that improvement or on the site shall not take precedence over the mortgage or trust deed. [Amended by 1965 c.446 §2; 1967 c.602 §2; 1975 c.466 §8; 1981 c.757 §6; 1983 c.513 §1; 1983 c.674 §3]

87.027 Right of owner to demand list of materials and labor; penalty for failure to provide list. An owner who receives a notice of the right to lien in accordance with the provisions of ORS 87.021 may demand, in writing, from the person providing materials or labor a list of materials or description of labor supplied or a statement of the contractual basis for supplying the materials or labor, including the percentage of the contract completed, and the charge therefor to the date of the demand. The supplier's statement shall be delivered to the owner within 15 days of receipt of the owner's written demand, as evidenced by a receipt or a receipt of delivery of a certified or registered letter containing the demand. Failure of the supplier to furnish the information requested constitutes a loss of attorney fees and costs otherwise allowable in a suit to foreclose a lien. [1981 c.757 §8]

87.030 Effect of owner having knowledge of improvement; notice of nonresponsibility. Every improvement except an improvement made by a person other than the landowner in drilling or boring for oil or gas, constructed upon lands with the knowledge of the owner shall be deemed constructed at the instance of the owner, and the interest owned shall be subject to any lien filed pursuant to the provisions of ORS 87.001 to 87.060 and 87.075 to 87.093, unless the owner shall, within three days after he obtains knowledge of the construction, give notice that he will not be responsible for the same by posting a notice in writing to that effect in some conspicuous place upon the land or the improvement situated thereon. [Amended by 1975 c.466 §9]

87.035 Filing of claim for lien. (1) Every person claiming a lien under ORS 87.010 (1) or (2) shall file the claim not later than 90 days after he has ceased to provide labor, rent equipment or furnish materials or 60 days after completion of construction, whichever is earlier. Every other person claiming a lien under ORS 87.010 shall file the claim not later than 60 days after the completion of the construction. All claims shall be filed as provided by subsection (2) of this section.

(2) The claim shall be filed for recording with the recording officer of the county or counties in which the improvement, or some part thereof, is situated and shall contain:

(a) A true statement of demand, after deducting all just credits and offsets;

(b) The name of the owner, or reputed owner, if known;

(c) The name of the person by whom the claimant was employed or to whom he furnished the materials or rented the equipment or by whom contributions are owed; and

(d) A description of the property to be charged with the lien sufficient for identification, including the address if known.

(3) The claim shall be verified by the oath of the person filing or of some other person having knowledge of the facts, subject to the criminal penalties for false swearing provided under ORS 162.075. [Amended by 1961 c.609 §1; 1973 c.671 §3; 1975 c.466 §10; 1983 c.517 §1]

87.039 Notice of filing claim for lien; effect of failure to give notice. (1) A person filing a claim for a lien as provided by ORS 87.035 shall deliver to the owner a notice in writing that the claim has been filed. The notice shall be delivered not later than 20 days after the date of filing. Notice delivered to the owner who received the notice of the right to lien as provided by ORS 87.021 shall be deemed in compliance with the requirement of this subsection, unless the person giving notice has actual knowledge of changed ownership.

(2) No costs, disbursements or attorney fees otherwise allowable as provided by ORS 87.060 shall be allowed to any party failing to comply with subsection (1) of this section. [1975 c.466 §14; 1983 c.674 §4]

Note: 87.039 was enacted into law by the Legislative Assembly but was not added to or made a part of 87.005 to 87.075 by legislative action. See Preface to Oregon Revised Statutes for further explanation.

87.040 [Repealed by 1975 c.466 §25]

87.045 Completion date of improvement; notice of completion, abandonment or nonabandonment; contents of notice. (1) The completion of construction of an improvement shall occur when:

(a) The improvement is substantially complete; or

(b) A completion notice is posted and recorded as provided by subsections (2) and (3) of this section; or

(c) The improvement is abandoned as provided by subsection (5) of this section.

(2) When all original contractors employed on the construction of an improvement have substantially performed their contracts, the owner or mortgagee or an agent of either shall post and record a completion notice in writing stating in substance the following:

Notice hereby is given that the building or structure on the following described premises, (insert the legal description of the property including the street address, if known) has been completed.

All persons claiming a lien upon the same under the Construction Lien Law hereby are notified to file a claim of lien as required by ORS 87.035.

Dated ————, 19—

————————

Owner or Mortgagee

P. O. Address: ————

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(3) Any notice provided for in this section shall be posted on the date it bears in some conspicuous place upon the land or upon the improvement situated thereon. Within five days from the date of posting the notice, the party posting it or his agent shall record with the recording officer of the county in which the property, or some part thereof, is situated, a copy of the notice, together with an affidavit indorsed thereon or attached thereto, made by the person posting the notice, stating the date, place and manner of posting the notice. The recording officer shall indorse upon the notice the date of the filing thereof and record and index the notice in the Construction Lien Book as required by ORS 87.050.

(4) Anyone claiming a lien under ORS 87.010 on the premises described in a completion or abandonment notice for labor performed and materials used prior to the date of the notice, shall file a claim of lien as required by ORS 87.035.

(5) Except as provided in subsection (6) of this section, an improvement is abandoned:

(a) On the 60th day after work on the construction of the improvement ceases; or

(b) When the owner or mortgagee of the improvement or an agent of either posts and records an abandonment notice in writing signed by either the owner or the mortgagee.

(6) When work on the construction of an improvement ceases, if the owner or mortgagee of the improvement intends to resume construction and does not want abandonment to occur, the owner or mortgagee or an agent of either shall post and record a nonabandonment notice in writing signed by either the owner or mortgagee. The notice of nonabandonment shall be posted and recorded not later than the 59th day after work on the construction ceases. The no-

tice of nonabandonment may be renewed at intervals of 180 days by rerecording the notice.

(7) The notices of abandonment or nonabandonment described in subsections (5) and (6) of this section shall state in substance:

(a) That the improvement is either abandoned or not abandoned.

(b) The legal description of the property, including the street address if known, on which the improvement is located.

(c) In the case of an abandonment notice, that all persons claiming a lien on the improvement should file a claim of lien as required by ORS 87.035.

(d) In the case of a nonabandonment notice, the reasons for the delay in construction.

(e) The date of the notice.

(f) The address of the person who signs the notice. [Amended by 1975 c.466 §11]

87.050 Recording. The recording officer of each county shall record all notices and claims required to be filed by the provisions of ORS 87.001 to 87.060 and 87.075 to 87.093 in a book kept for that purpose, and titled "Construction Lien Book." The notices and claims recorded in the Construction Lien Book shall be indexed as deeds and other conveyances are required by law to be indexed and shall constitute a public record of the county. [Amended by 1975 c.466 §12]

87.055 Duration of lien. No lien described in ORS 87.010 shall bind any improvement for a longer period than six months after the lien is filed unless suit is brought in a proper court within that time to enforce the lien, or if extended payment is provided and the terms thereof are stated in the recorded lien, then six months after the expiration of such extended payment, but no lien shall be continued in force for a longer time than two years from the time the claim for lien is filed under ORS 87.035 by any agreement to extend payment. [Amended by 1975 c.466 §13]

87.057 Notice of intent to foreclose; list of materials furnished and statement of prices; effect of failure to give notice. (1) A person intending to commence suit to foreclose a lien shall deliver to the owner of the property upon which the lien is claimed and to the mortgagee a notice in writing not later than 10 days prior to commencement of the suit, stating that such person, or others, intends to commence suit to foreclose the lien. Notice delivered to the mortgagee who received the notice required by ORS 87.025 shall be deemed in compliance with this subsection, unless the person giving notice has actual knowledge of a change of mortgagee.

(2) Where a notice of intention to commence suit to foreclose a lien has been given as provided by subsection (1) of this section, the sender of the notice upon demand of the owner shall furnish to the owner within five days after the demand a list of the materials and supplies with the charge therefor, or a statement of a contractual basis for the owner's obligation, for which a claim will be made in the suit to foreclose.

(3) A plaintiff or cross-complainant seeking to foreclose a lien in a suit to foreclose shall plead and prove compliance with subsections (1) and (2) of this section. No costs, disbursements or attorney fees otherwise allowable as provided by ORS 87.060 shall be allowed to any party failing to comply with the provisions of this section. [1975 c.466 §15]

Note: 87.057 was enacted into law by the Legislative Assembly but was not added to or made a part of 87.005 to 87.075 by legislative action. See Preface to Oregon Revised Statutes for further explanation.

87.058 Stay of foreclosure proceedings; requirements; procedure; duration of stay. (1) As used in this section:

(a) "Builder" has the meaning given that term in ORS 701.005.

(b) "Board" means the Builders Board established in ORS 701.205.

(c) "Structure" means a residence, duplex or multiunit residential building.

(2) When a suit to enforce a lien created by ORS 87.010 is filed and the owner of the structure subject to that lien files a claim with the board under ORS 701.145 against a builder who performed work that is subject to ORS chapter 701 on the structure, the owner may obtain a stay of proceedings on the suit to enforce the lien if:

(a) The owner already has paid a builder for that builder's work that is subject to this chapter on the structure;

(b) The person suing to enforce the lien created by ORS 87.010:

(A) Performed work that is subject to ORS chapter 701 on the structure for the builder who has been paid by the owner;

(B) Furnished labor or materials or rented or supplied equipment used on the structure to the builder who has been paid by the owner; or

(C) Otherwise acquired the lien under ORS 87.010 as a result of a contribution toward completion of the structure for which the builder has been paid by the owner; and

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(c) The continued existence of the lien on which the suit is pending is attributable to the failure of the builder who has been paid by the owner to pay the person suing for that person's contribution toward completion of the structure.

(3) The owner may petition for the stay of proceedings described in subsection (2) of this section by filing the following papers in the circuit court in which the suit on the lien is pending:

(a) A certified copy of the claim filed with the board under ORS 701.145; and

(b) An affidavit signed by the owner that contains:

(A) A description of the structure;

(B) The street address of the structure;

(C) A statement that the structure is the structure upon which the suit to enforce the lien is pending; and

(D) A statement that the petitioner is the owner of the structure.

(4) Upon receipt of a complete petition described in subsection (3) of this section, the circuit court shall stay proceedings on the suit to enforce the lien.

(5) After the board has adjudicated or otherwise completely processed the claim against the builder's bond or deposit, the circuit court shall dissolve the stay ordered under subsection (4) of this section. [1981 c.618 §16]

87.060 Foreclosure; right to jury trial; distribution of proceeds of foreclosure sale. (1) Suits to enforce the liens created by ORS 87.010 shall be brought in the circuit courts, and the pleadings, process, practice and other proceedings shall be the same as in other cases.

(2) In suits to enforce the liens created by ORS 87.010, evidence of the actual costs of the labor and material provided by the lien claimant establishes a rebuttable presumption that those costs are the reasonable value of that labor and material.

(3) In suits to enforce the liens created by ORS 87.010, the court shall allow or disallow the lien. If the lien is allowed, the court shall proceed with the foreclosure of the lien and resolve all other pleaded issues. If the lien is disallowed, and a party has made a demand for a jury trial as provided for in subsection (4) of this section, the court shall empanel a jury to decide any issues triable of right by a jury. All other issues in the suit shall be tried by the court.

(4) A party may demand a trial by jury of any issue triable of right by a jury after the lien is disallowed, if that party serves a demand therefor in writing upon the other parties at any time prior to commencement of the trial to foreclose the lien. The demand shall be filed with the court. The failure of a party to serve a demand as required by this subsection shall constitute a waiver by the party of trial by jury. A demand for trial by jury made as provided in this subsection may not be withdrawn without the consent of the parties.

(5) When notice of intention to commence suit to foreclose the lien has been given, pleaded and proven as provided for in ORS 87.057, the court, upon entering judgment for the lien claimant, shall allow as part of the costs all moneys paid for the filing or recording of the lien and all moneys paid for title reports required for preparing and foreclosing the lien. In suits to enforce a lien created by ORS 87.010 the court shall allow a reasonable amount as attorney fees at trial and on appeal to the party who prevails on the issues of the validity and foreclosure of the lien.

(6) In case the proceeds of any sale under ORS 87.001 to 87.060 and 87.075 to 87.093 are insufficient to pay all lienholders claiming under such statutes, the liens of all persons shall be paid pro rata. Each claimant is entitled to execution for any balance due the claimant after the distribution of the proceeds, and that execution shall be issued by the clerk of the court, upon demand, after the return of the sheriff or other officer making the sale showing the balance due.

(7) All suits to enforce any lien created by ORS 87.010 shall have preference on the calendar of the court over every civil suit, except suits to which the state is a party, and shall be tried by the court without unnecessary delay. In such suits, all persons personally liable, and all lienholders whose claims have been filed for record under the provisions of ORS 87.035, shall, and all other persons interested in the matter in controversy, or in the property sought to be charged with the lien, may be made parties; but persons not made parties are not bound by the proceedings. The proceedings upon the foreclosure of the liens created by ORS 87.010 shall, as nearly as possible, conform to the proceedings of a foreclosure of a mortgage lien upon real property. [Amended by 1975 c.466 §16; 1981 c.897 §20; 1981 c.898 §44; 1983 c.517 §2]

87.065 [Amended by 1961 c.609 §2; repealed by 1975 c.466 §25]

87.070 Amount of recovery by contractor; respective rights of contractor and owner. Any contractor may recover, upon a lien filed by him, only the amount due to him according to the terms of his contract, after deducting all claims of other parties for work done and materials furnished for which a lien is created by ORS 87.010. Where a lien is filed under ORS 87.005 to 87.075 for work done or material furnished to any contractor, he shall defend any action brought thereupon at his own expense, and during the pendency of such action the owner may withhold from the contractor the amount of money for which such lien is filed. In case of judgment against the owner or his property upon the lien, the owner may deduct from any amount due or to become due by him to the contractor the amount of such judgment and costs; and if the amount of the judgment and costs exceeds the amount due by him to the contractor, or if the owner has settled with the contractors in full, he may recover back from the contractor any amount so paid in excess of the contract price, and for which the contractor was originally the party liable.

87.075 Exemption of building materials from attachment by third persons. When a person furnishes or procures materials for use in the construction of an improvement, those materials are not subject to attachment, execution or other legal process to enforce any debt due by the purchaser of the materials, except a debt due for the purchase money thereof, so long as in good faith the materials are about to be applied to the construction of the improvement. [Amended by 1975 c.466 §23]

87.076 Bond or deposit of money; amount. (1) The owner of an improvement or land against which a lien provided for by ORS 87.010 is claimed, or any other interested person, may file with the recording officer of the county in whose office the claim for lien is filed a bond executed by a corporation authorized to issue surety bonds in the State of Oregon to the effect that the owner of the improvement or land against which the lien is claimed shall pay the amount of the claim and all costs and attorney fees which are awarded against the improvement or land on account of the lien. The bond shall be in an amount not less than 150 percent of the amount claimed under the lien, or in the amount of $1,000, whichever is greater.

(2)(a) In lieu of the surety bond provided for in subsection (1) of this section, the owner of an improvement or land against which a lien provided by ORS 87.010 is claimed, or any other interested person, may deposit with the treasurer of the county in which the claim for lien is filed a sum of money or its equivalent equal in value to 150 percent of the amount claimed under the lien, or in the amount of $1,000, whichever is greater.

(b) The court in which any proceeding to foreclose the lien may be brought may, upon notice and upon motion by a person who makes a deposit under paragraph (a) of this subsection, order the money invested in such manner as the court may direct. A person who makes a deposit under paragraph (a) of this subsection shall be entitled to any income from the investments and the treasurer of the county shall pay the income when received to the depositor without order.

(3) A bond or money may be filed or deposited under subsection (1) or (2) of this section at any time after the filing of the claim for lien under ORS 87.035. [1975 c.466 §17; 1983 c.513 §3]

87.078 Notice of filing bond or depositing money; contents of notice; effect of failure to give notice. (1) A person who files a bond or deposits money under ORS 87.076 shall cause to be served upon the lien claimant a notice of the filing or deposit and, if a bond, a copy thereof, not later than 20 days after the filing or deposit. The notice shall state the location and time of the filing or deposit.

(2) If a person does not notify the lien claimant as required by subsection (1) of this section, the filing of the bond or the deposit of money is of no effect and the provisions of ORS 87.083 shall not apply in a suit to foreclose the lien for which the filing or deposit is made. [1975 c.466 §18]

87.080 [Amended by 1967 c.407 §3; repealed by 1975 c.648 §72]

87.081 Filing affidavit with county officer. (1) When a person files a bond with the recording officer of the county under ORS 87.076 and serves notice of the filing upon the lien claimant, he shall file with the same recording officer an affidavit stating that such notice was served.

(2) When a person deposits money with the treasurer of a county under ORS 87.076 and serves notice of the deposit upon the lien claimant, he shall file with the recording officer of the same county an affidavit stating that the deposit was made and notice served. [1975 c.466 §19]

87.082 [1967 c.407 §§1,2; repealed by 1975 c.648 §72]

87.083 Foreclosure after filing of bond or deposit of money; effect of filing or deposit; disposition of bond or money. (1) Any suit to foreclose a lien pursuant to ORS 87.060 which is commenced or pending after the filing of a bond or deposit of money under ORS 87.076 shall proceed as if no filing or deposit had been made except that the lien shall attach to the bond or money upon the filing or deposit and the service of notice thereof upon the lien claimant. The property described in the claim for lien shall thereafter be entirely free of the lien and shall in no way be involved in subsequent proceedings.

(2) When a bond is filed or money is deposited, if, in a suit to enforce the lien for which the filing or deposit is made, the court shall allow the lien, the lien shall be satisfied out of the bond or money. The court shall include as part of its judgment an order for the return to the person who deposited the money of any amount remaining after the lien is satisfied.

(3) When a bond is filed or money is deposited, if, in a suit to enforce the lien for which the filing or deposit is made, the court shall disallow the lien, the court shall include as part of its judgment an order for the return of the bond or money to the person who filed the bond or money. [1975 c.466 §20]

87.085 [Repealed by 1975 c.648 §72]

87.086 Determination of adequacy of bond. If a lien claimant considers the bond filed with a recording officer of a county inadequate to protect his claim for lien for some reason other than the amount of the bond, he shall, within 10 days of receipt of the notice of filing, petition the court in which the suit to foreclose the lien may be brought for a determination of the adequacy of the bond. The lien claimant shall state in detail the reasons for the inadequacy. Not later than two days after the filing of the petition with the court, the lien claimant shall send a notice of the filing and a copy of the petition by registered or certified mail to the person who filed the bond. After a hearing, if the court determines that the bond is inadequate for one or more of the reasons stated by the lien claimant, the court shall order such action as shall make the bond adequate to protect the claim for lien. [1975 c.466 §21]

87.088 Return of bond or money. The recording officer or treasurer of a county in whose office a bond or money is filed or deposited under ORS 87.076 shall return it to the person who made the filing or deposit when:

(1) A suit to foreclose the lien is not commenced within the time specified by ORS 87.055; or

(2) The person who filed the bond or deposited the money presents a certified copy of a court's order for the return of the bond or all or some of the money to that person; or

(3) The person who filed the bond or deposited the money presents a written release of lien signed by the lien claimant. [1975 c.466 §22]

87.090 [Repealed by 1975 c.648 §72]

87.093 Information Notice to Owner; adoption by Builders Board; contents; when notice must be given; penalty for failure to provide. (1) The Builders Board shall adopt by rule a form entitled "Information Notice to Owner" which shall describe, in nontechnical language and in a clear and coherent manner using words in their common and everyday meanings, the pertinent provisions of the Construction Lien Law of this state and the rights and responsibilities of an owner of property and an original contractor under that law. The rights and responsibilities described in the form shall include, but not be limited to:

(a) Methods by which an owner may avoid multiple payment for the same materials and labor;

(b) The right to file a claim against a registered builder with the Builders Board and, when appropriate, to be reimbursed from the builder's bond filed under ORS chapter 701; and

(c) The right to receive, upon written request therefor, a statement of the reasonable value of materials or labor provided from the persons providing the materials or labor at the request of an original contractor and who have also provided notices of the right to lien.

(2)(a) Each original contractor shall provide a copy of the "Information Notice to Owner" adopted by the Builders Board under this section to:

(A) The first purchaser of residential property constructed by the contractor and sold within the 60-day period immediately following the completion of construction; and

(B) The owner or an agent of the owner, other than an original contractor, at the time of signing a written residential construction or improvement contract with the owner.

(b) When the residential construction or improvement contract is an oral contract, the original contractor shall mail or otherwise deliver the "Information Notice to Owner" not later than five days after the contract is made.

(3) This section applies only to a residential construction or improvement contract for which the aggregate contract price exceeds $1,000. If the price of a home improvement contract was initially less than $1,000, but during the course of the performance of the contract exceeds that amount, the original contractor shall mail or

otherwise deliver the "Information Notice to Owner" not later than five days after the contractor knows or should reasonably know that the contract price will exceed $1,000.

(4) An "Information Notice to Owner" need not be sent when the owner is a builder registered with the Builders Board under ORS chapter 701.

(5) Notwithstanding ORS 87.010, if an original contractor does not provide an owner or agent with an "Information Notice to Owner" as required under subsections (2) and (3) of this section, the original contractor may not claim any lien created under ORS 87.010 upon any improvement, lot or parcel of land of the owner for labor, services or materials supplied under the residential construction or improvement contract for which the "Information Notice to Owner" was not provided.

(6) If an original contractor does not provide an owner or agent with an "Information Notice to Owner" as required under subsection (2) of this section, the Builders Board may suspend the certificate of registration of the original contractor for any period of time that the board considers appropriate or impose a civil penalty of not more than $1,000 upon the original contractor as provided in ORS 701.992.

(7) As used in this section:

(a) "Residential construction or improvement" means the original construction of residential property and constructing, repairing, remodeling or altering residential property and includes, but is not limited to, the construction, repair, replacement or improvement of driveways, swimming pools, terraces, patios, fences, porches, garages, basements and other structures or land adjacent to a residential dwelling.

(b) "Residential construction or improvement contract" means an agreement, oral or written, between an original contractor and an owner for the performance of a home improvement and includes all labor, services and materials furnished and performed thereunder. [1981 c.757 §9; 1983 c.757 §3]

87.095 [Repealed by 1975 c.648 §72]

87.100 [Amended by 1973 c.54 §1; repealed by 1975 c.648 §72]

87.105 [Repealed by 1975 c.648 §72]

87.110 [Repealed by 1975 c.648 §72]

87.115 [Repealed by 1975 c.648 §72]

87.120 [Repealed by 1975 c.648 §72]

87.122 [1955 c.438 §§1,2; repealed by 1975 c.648 §72]

87.125 [Amended by 1967 c.327 §1; 1973 c.307 §1; repealed by 1975 c.648 §72]

87.130 [Amended by 1961 c.519 §1; repealed by 1975 c.648 §72]

87.135 [Repealed by 1975 c.648 §72]

87.140 [Repealed by 1975 c.648 §72]

OREGON ADMINISTRATIVE RULES

BUILDERS BOARD

CHAPTER 812

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DIVISION 1

ADMINISTRATION

Notice of Proposed Rule

812-01-000 Before adopting, amending, or repealing any rule, the Builders Board shall give notice of the proposed adoption, amendment, or repeal:

(1) In the Secretary of State's Bulletin at least 15 days before the effective date of the rule.

(2) By mailing a copy of the notice to persons on the Builders Board's mailing list established pursuant to ORS 183.335(7).

(3) By mailing a copy of the notice to the following organizations or publications:

(a) Associated Floorcovering Contractors;
(b) Associated General Contractors;
(c) Associated Press;
(d) Building Material Dealers Association;
(e) Homebuilders Association of Metropolitan Portland;
(f) Independent Electrical Contractors of Oregon;
(g) Independent Plumbing and Electrical Contractors;
(h) Manufactured Housing Dealers Association;
(i) National Electrical Contractors Association;
(j) Oregon Association of Plumbing, Heating and Cooling Contractors;
(k) Oregon Labor Press;
(l) Oregon Manufactured Housing Association;
(m) Oregon Remodelers Association;
(n) Oregon State Homebuilders Association;
(o) Surety Association of Oregon;
(p) United Press International;
(q) Capitol Press Room, State Capitol.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 4, f. & ef. 12-29-75; 1BB 1-1978, f. & ef. 5-23-78; 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1982, f. 3-31-82, ef. 4-1-82

General Procedures

812-01-003 (1) The Builders Board adopts the Attorney General's Model Rules of Procedure, filed with the Secretary of State on November 18, 1981, except 137-04-020(1). 137-04-020(1) is replaced by the following:

(1) To be timely received, the following items must be received by the Agency within 20 days from the date a proposed order is mailed by the Agency:

(a) A request for hearing;

(b) Exceptions to an Agency order.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1982, f. 3-31-82, ef 4-1-82; 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef 3-1-83; 1BB 2-1983, f. & ef. 7-6-83

Hearings Postponements

812-01-005 A postponement of a hearing may be granted at the request of a party if:

(1) The request is promptly made after the party receives the notice of hearing; and

(2) The party has good cause as stated in the request, for not attending the hearing at the time and date set. For the purposes of this section, good cause exists when:

(a) The circumstances causing the request are beyond the reasonable control of the requesting party; and

(b) Failure to grant the postponement would result in undue hardship to the requesting party.

Stat. Auth. ORS Ch. 183 & 701
Hist 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 1-1978, f. & ef. 5-23-78; 1BB 3-1978, f. & ef. 12-4-78; 1BB 2-1979, f. & ef. 12-19-79; 1BB 1-1980, f. & ef. 2-29-80; 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1983, f. & ef. 3-1-83

Notices

812-01-010 (1) The following notices shall be deemed properly served by the Builders Board when delivered personally or deposited in the United States mail, registered or certified mail, addressed to the builder or to any other entity having an interest in any proceeding before the Builders Board, at that entity's last known address of record with the Builders Board:

(a) Notice of Hearing;

(b) Notice of Revocation or Suspension of a Certificate of Registration;

(c) Proposed or Final Civil Penalty Order;

(d) Proposed or Final Order in the Matter of a Claim, adjudicated under rule 812-04-055.

(2) All other notices under ORS Chapter 701 or these rules shall be deemed properly served by the Builders Board when delivered personally or deposited in the United States mail, regular mail, to the addressee's last known address of record with the Builders Board.

(3) Time for response to all notices shall run from the date of mailing.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 1-1978, f. & ef. 5-23-78; 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1983, f. & ef. 3-1-83

Information Requests

812-01-015 (1) The Agency will provide the following information in response to telephone requests for registration information relating to a specific entity:

(a) Whether or not the entity is or has ever been registered;

(b) The registration number(s);

(c) The Business names used by the entity of record with the Agency;

(d) Type of business organization (individual proprietorship, partnership, or corporation);

(e) Personal names of owners, partners, or corporate officers;

(f) Last known address;

(g) Type of registration (residential or residential/ commercial/ industrial);

(h) Expiration date or date upon which the registration became inactive and the reason it became inactive;

(i) The date the entity first became registered.

(2) If more information is required than that listed in section (1) of this rule, the request for information should be made in writing.

(3) The Agency will provide the following information in response to telephone requests for claims information relating to a specific registrant:

(a) Number of claims filed;

(b) The status of each claim (closed or in process);

(c) Type of each claim filed;

(d) Date upon which each claim was filed;

(e) Alleged amount of the claim or amount awarded.

(4) If more information is required than that listed in section (3) of this rule, the request for information should be made in writing.

(5) If no claims have been filed or if the entity about whom the inquiry is being made is nonregistered, the caller will be given this information by telephone. If claims exist, the caller will be sent this information in writing by mail.

(6) Telephone requests for registration or claim information will be limited to three names per call. No more than one call daily should be made by any person, business or agency. When information is readily accessible, the caller will be answered immediately if staffing permits. Otherwise, the Agency will attempt to return the call within 24 hours. If information is required for more than three names, the request should be made in writing.

(7) Written requests for registration or claim information should be submitted in the form of a list alphabetized by the entities' business names. Included on the list should be all known assumed business names used by the entity as well as the owners' names, addresses and/or cities, and registration numbers, if known. The list should include headings for each type of information required. The Agency will complete the research and return the list to the person making the inquiry as quickly as workload and staffing allow.

(8) If the Agency is unable to fulfill an information request because of staffing limitations, because of the extensive nature of the request, etc., the person making the request may review the Agency's records at 403 Labor and Industries Building, Salem, Oregon 97310 from 8 a.m. to 5 p.m. Monday through Friday.

(9) The Agency may make the following charges for records:

(a) $5 for each certification that an individual or business has or has not been registered with the Builders Board. This certification will include the following information:

(A) Registration number(s).

(B) Name of registered entity and any assumed business names registered with the Agency.

(C) Type of business organization (individual proprietorship, partnership or corporation).

(D) Personal names of owner, partners or corporate officers.

(E) The important dates in the registration history and the action that took place on those dates.

(b) $5 for certified copies of documents;

(c) $5 for every 20 copies made;

(d) $10 per tape for duplicate tape recordings of agency hearings.

Stat. Auth.: ORS Ch. 701
Hist: 1BB 1-1983, f. & ef. 3-1-83

Information Notice to Owners

812-01-020 The Builders Board adopts form 814-070-157 (revised October 1983) entitled **"Information Notice to Owner about Construction Liens"**. This form may be obtained from the Builders Board. Use of the January 1, 1983, revision will suffice to fulfill requirements of ORS 87.093 until supplies are exhausted.

Stat. Auth.: ORS Ch. 87 & 701
Hist: 1BB 4-1981, f. 11-24-81, ef. 1-1-82; 1BB 3-1982, f. 6-4-82, ef. 1-1-83; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-076; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

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DIVISION 2

DEFINITIONS

Definitions

812-02-000 As used in these rules:

(1) "Board" means the five-member appointed Builders Board.

(2) "Agency" means the administrative agency including the staff of the Builders Board.

(3) "Builder" includes, but is not limited to, entities which, in the pursuit of an independent business, undertake or offer to undertake or submit a bid to perform or arrange for the performance of any of the following, unless excluded under ORS 701.010 or rule 812-03-010:

(a) Construction, alteration, repair, improvement, moving, or demolition of residential apartments of four units or less, homes, carports, garages, or condominiums, whether done speculatively or under contract;

(b) Alteration, repair, improvement, set-up or demolition of mobile homes, whether done speculatively or under contract;

(c) Installation or repair in a residence of:

Air conditioning;
Alarm systems (electrical; built-in);
Awnings;
Barbecues (built-in);
Basements;
Bathtubs or bathtub enclosures;
Cabinets;
Carpeting or other floor coverings;
Chimneys or flues;
Countertops;
Drywall or plaster;
Electric wiring;
Elevators;
Fans or ventilating equipment;
Fireplaces or wood-burning stoves;
Foundations;
Framing;
Furnaces or other heating equipment;
Garage doors or garage door opening equipment;
Glass or glazing;
Hardwood flooring;
Hot water tanks;
Insulation, storm windows, or other weatherization;
Intercom systems (electrical);
Iron or other metal work;
Laminates;
Lath;
Masonry;
Millwork and trim;
Painting (exterior and interior);
Paneling;
Plumbing;
Roof structures;
Roofing or flashing;
Sandblasting;
Saunas, hot tubs, spas (built-in);
Screen doors;
Security systems (electrical);
Sheet metal;
Shower doors or shower enclosures;
Siding;
Skylights;
Solar energy systems or equipment;
Stairways;
Stucco or gunite;
Tile or grouting;
Underlayment;
Vacuum systems (built-in);
Wallcovering installers;
Water purification or conditioning equipment;
Waterproofing;
Weatherstripping

(d) Performance of the following work on land owned by the owner of the structure:

(A) Excavation for the structure or its appurtenances.

(B) Backfill or grading when rough grading the site to accomplish proper drainage and not for landscaping.

(C) Trenching when done for the structure or its appurtenances and not for landscaping or the installation of sprinkling systems.

(D) Concrete flatwork, including installation, cutting or breaking, when related to the structure or its appurtenances. This does not apply to concrete flatwork on retaining walls and walkways when done only in conjunction with landscaping work.

(E) Curbing or paving when related to the structure or its appurtenances.

(F) Installation or repair of an "appurtenance" as defined in section (8) of this rule.

(e) Work performed on a residence related to pest control if in the course of that work any structural repairs are performed, any wood is replaced, or any other work is performed which is subject to ORS Chapter 701;

(f) The erection of modular housing constructed off-site.

(4) "Builder" also includes, but is not limited to, any entity which in the pursuit of an independent business as a builder, contracts for labor only, regardless of whether compensated by the hour or by the job.

(5) A builder also includes, but is not limited to, a developer who, with the intent of selling residence(s), contracts with a general contractor to construct, alter or improve residence(s) on land owned by the developer.

(6)(a) If a builder is registered for residential work only, "structure" includes residential buildings of four units or less and does not include commercial improvements or dwellings otherwise residential in nature used for commercial purposes;

(b) "Structure" includes modular and mobile homes. However, the manufacturer of a mobile home constructed under federal standards is exempt from jurisdiction of the Board.

(7) "Entity" means an individual, a partnership or a corporation.

(8) "The pursuit of an independent business" as used in ORS 701.005(2) means that entity operates as an independent contractor. Evidence of operating as an independent contractor and not as an employe may include, but not be limited to, the following criteria:

(a) Is free from close supervision by the homeowner or contractor over the details of the work being performed, including hours of work;

(b) Enters into a contract, either oral or written, which calls for the completion of a certain type, kind or piece of work on a specific project or job site for which payment is made on a per-hour or time-and-materials basis, or for the entire job;

(c) May have two or more effective contracts at any one time;

(d) Hires and supervises other subcontractors and/or employes and may be responsible for business insurance and payroll taxes if help is hired;

(e) Enters into a contract, either oral or written, which does not require the employer to consider remuneration paid to be wages for the purposes of unemployment compensation benefits, workers' compensation payments, or federal or state withholding;

(f) Uses as normal business practices, telephone service, business cards, or commercial advertising;

(g) Furnishes substantially all of the equipment, tools, and supplies necessary to carry out contractual obligations;

(h) May be registered with the Employment Division's Contractor Certification Fund.

(9) "Appurtenance" is limited to one of the following, located on land owned by the owner of the structure to enhance the residential use of the structure:

(a) Garage or carport;

(b) Porch, patio, decks and deck steps, walkways, or fencing. This does not apply to decks, decksteps, walkways or fencing when such work is done only in conjunction with landscaping work;

(c) Driveway;

(d) An installation for domestic water supply or the conveyance of water from raingutters or the foundation area to its point of outfall;

(e) A retaining wall when necessary to protect a structure or its appurtenances or to comply with building code slope requirements or when done not in conjunction with landscaping work;

(f) Swimming pools.

(10) "Speculative" means in anticipation of or with the intent of selling to another entity during or after construction.

(11) A "general contractor" is a registrant who has a contract, either oral or written, with the owner of a structure to perform work subject to ORS Chapter 701, or who is building a structure speculatively; who may engage one or more subcontractors to perform all or part of the work; and who has responsibility for the entire project which is the subject of the contract. Responsibility for the entire project includes seeing that prompt and proper payment is made to all subcontractors [illegible] performed work on the structure and to all suppliers of [illegible]erial fabricated into the structure, thereby preventing the filing of construction liens against the property.

(12) A "subcontractor" is a registrant who has a contract, either oral or written, with a general contractor but not with the owner of the structure to perform work subject to ORS Chapter 701 and who is responsible for a specific portion of the entire project.

(13) "Work period" means the time from the date a contract is entered into until the date the contracted work is completed or substantially completed.

(14) "Substantial completion" may include but not be limited to the following conditions: completion of final inspection, issuance of a certificate of occupancy, the house or portion of house in a habitable or usable condition.

(15) "Monetary damages" is the dollar amount required in excess of the contract amount to provide the claimant what was agreed to be provided under the terms of the contract minus any amount due and unpaid the registrant.

(16) "Labor" as used in ORS 701.140(4) means work subject to ORS Chapter 701 performed as an employe of a registrant as well as work subject to ORS Chapter 701 provided through a contractural relationship between a general contractor and a subcontractor.

(17) A "developer" is a person who owns property and contracts with a general contractor to construct, improve or alter one or more residences on the land for the purpose of selling those residences to their final owners.

(18) "For compensation and with the intent to sell" as used in ORS 701.005 is not intended to include real estate licensees engaged in professional real estate activities as defined in ORS 696.010(9).

Stat. Auth.: ORS Ch. 701

Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 7, f. & ef. 11-14-77; 1BB 1-1978, f. & ef. 5-23-78; 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-005; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

(19) An "owner," for purposes of ORS 701.140(1) and (2) means a person not in pursuit of an independent business as a builder, who purchases a residence from a builder or developer as defined in ORS chapter 701 and OAR chapter 812 and intends to own that residence indefinitely either as a personal residence or as a rental. An "owner" cannot be a general contractor as defined in subsection (11) of this rule or a developer as defined in subsection (17) of this rule unless that general contractor or developer continues to own the home as his or her personal residence or as a rental.

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DIVISION 3

REGISTRATION

Registration Generally

812-03-000 (1) A certificate of registration will be issued to one entity only. Other entities shall not be included in that certificate, but each shall be separately registered and shall separately meet the requirements of registration. No entity may perform work subject to ORS Chapter 701 through the use of another entity's certificate of registration except as an employe of the registrant.

(2) Registration shall be limited to residential work unless the Agency receives a written request from the registrant at the time of application for registration or renewal to extend the registration to cover all types of buildings.

(3) If an entity registered as an individual, partnership, or corporation seeks to change the registered entity to another type, the former registration will be terminated and the new entity must register anew.

(4) All partners within a partnership shall be of record with the Builders Board. Registration becomes invalid upon any change in the composition of that partnership.

(5) Each entity shall list on its application for registration or renewal all assumed business names under which business as a builder is conducted. All assumed business names listed shall be on record with the Corporation Commissioner.

(6)(a) A certificate of registration is valid for the term for which it is issued only if the following conditions are met throughout the registration period:

(A) The surety bond or security agreement remains in effect and undiminished by payment of damages awarded to claimants, and

(B) The insurance required by ORS 701.105 remains in effect, and

(C) If the registrant is an individual, survival of that individual, and

(D) If the registrant is a partnership, no change in the composition of that partnership, by death or otherwise, or

(E) If the registrant is a corporation, survival of that corporation, including compliance with all applicable laws governing corporations.

(b) If the registrant's bond is cancelled, the registration will lapse 30 days from the date the cancellation notice is received by the board;

(c) An entity whose certificate of registration has lapsed is considered nonregistered from the date the lapse occurred until the date the deficiency is corrected. During a period of lapse, the entity shall not perform the work of a builder;

(d) A period of lapse will end and the certificate of registration previously issued will again become valid on the date upon which the Agency receives a new bond or a notice of reinstatement for the existing bond. If the surety bond or security agreement becomes diminished by payments of damages awarded to claimants, the Agency will take the action set forth in rule 812-03-030. If the Agency receives information that the registrant's insurance has been cancelled, the Agency will take the action set forth in rule 812-03-015;

(e) If a certificate of registration becomes invalid, the Agency may require the return of the certificate and pocket card(s).

(7) No builder shall advertise or otherwise hold out to the public that person's services as a builder unless that builder holds a current, valid certificate of registration, nor shall any builder claim by advertising or by any other means to be bonded, insured, or registered unless that builder holds a current, valid certificate of registration.

(8) The annual fee for original registration or renewal of registration is $55.

(9) Reciprocity with other states shall be limited to the exchange of information.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 7, f. & ef. 11-14-77; 1BB 1-1978, f. & ef. 5-23-78; 1BB 3-1980(Temp), f. 6-2-80, ef. 7-1-80; 1BB 4-1980, f. & ef. 7-14-80; 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1982, f. 3-31-82, ef. 4-1-82; 1BB 2-1982, f. 4-1-82, ef. 7-1-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-010; 1BB 2-1983, f. & ef. 7-6-83; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

[ED. NOTE: The text of Temporary Rules is not printed in the Oregon Administrative Rules Compilation. Copies may be obtained from the adopting agency or the Secretary of State.]

Record Changes

812-03-005 (1) Requests for record changes necessitating a new certificate of registration shall be accompanied by a $10 fee.

(2) Requests for name changes of the registrant shall be accompanied by a rider to the security to cover the new name.

(3) The registrant shall advise the Agency of address changes within ten days of the date the change occurs. No charge will be made for address changes on the record. Former registrants shall inform the Agency of address changes for one year after registration expires or is otherwise terminated.

Stat. Auth.: ORS Ch. 701
Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 7, f. & ef. 11-14-77; 1BB 1-1978, f. & ef. 5-23-78; 1BB 5-1980, f. & ef. 10-7-80; 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-015; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

Exclusions From Registration

812-03-010 (1) "Casual, minor or inconsequential" as used in ORS 701.010(4) means work not of a structural nature which cannot affect the health or safety of the owner or occupant of the structure.

(2) ORS 701.010(6) does not apply to an entity performing work on a structure owned by that entity if such work is performed speculatively.

(3) "Owner" as used in ORS 701.010(5) does not mean an entity which builds or arranges to have built a structure for speculative purposes.

(4) ORS 701.010(10) applies only when the licensee is operating within the scope of that license.

Stat. Auth.: ORS Ch. 701
Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 1-1978, f. & ef. 5-23-78; 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-020

Applications for Registration

812-03-015 (1) The original, fully-executed surety bond or security agreement in lieu of a bond shall be on file with the Agency before a certificate of registration may be issued.

(2)(a) An applicant for registration or renewal shall certify that the applicant has procured insurance as required by ORS 701.105 and will continue to meet those insurance requirements for as long as the applicant is registered;

(b) This certification constitutes satisfactory evidence of insurance and is in lieu of any other evidence of insurance;

(c) If the requirements of subsection (2)(a) of this rule have been met, and the Agency receives a notice of cancellation, the Agency may:

(A) Send a notice to the registrant, by regular mail, reminding the registrant of the obligation imposed by the

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rant's certification referred to in subsection (2)(a) of this rule, and

(B) Inquire of the registrant if the registrant wants to terminate the registration. If an affirmative response is received, the registration shall be terminated. If a negative response or no response is received, no further action is required of the Agency.

(d) The registrant shall maintain the insurance required by ORS 701.105 in effect continuously until the certificate of registration is terminated, revoked, or expired. If the registrant, in performance of work subject to ORS Chapter 701, through failure to comply with this subsection, causes damage to another entity or to the property of another person for which that entity could have been compensated by an insurance company had the required insurance been in effect, the Agency may assess a civil penalty against the registrant in an amount up to $1,000 in addition to such other action as may be taken under ORS 701.135.

(3)(a) A complete application for registration includes:

(A) A completed application form.

(B) The certification referred to in subsection (2)(a) of this rule.

(C) A properly executed bond or "Agreement with Depositor and Trustee" referred to in rule 812-03-020(7), and

(D) The application fee.

(b) The Agency may return an incomplete application for registration to the applicant with an explanation of the deficiencies.

(4) A certificate of registration shall be issued by the Agency effective on the date on which all fees required by law have been paid and all documents required by law and by these rules are on file with the Agency.

t. Auth.: ORS Ch. 701
ist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 7, f. & ef. 11-14-77; 1BB 1-1978, f. & ef. 5-23-78; 1BB 2-1979, f. & ef. 12-29-79; 1BB 5-1980, f. & ef. 10-7-80; 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-025

Bonds and Deposits

812-03-020 (1) Effective December 1, 1983, a surety bond's effective date will be the date on which the registrant has met all requirements for registration or renewal, and the bond's expiration date will be one year from the effective date. The surety company will be responsible for ascertaining the bond's effective and expiration dates for the surety company's records. The surety will retain the right to cancel the bond.

(2) A surety bond may be cancelled only after the surety has given 30 days' notice to the Agency. Cancellation will be effective 30 days after receipt of the cancellation notice or he effective date of a replacement bond, whichever occurs first. Otherwise, a surety bond will remain in effect no less than one year following termination, revocation, or expiration of the builder's registration, except as provided in section (5) of this rule.

(3) The surety shall pay, to the limit of the bond, final orders of the Agency under ORS 701.145, except when payment is promptly made by the registrant.

(4) The name of the entity as it appears on the bond must be identical to the name on the application:

(a) If the entity is an individual proprietorship, the bond must include the name of the owner and any business name(s) used;

(b) If the entity is a partnership, the bond must include the names of all partners (except limited partners) and any bu s name(s) used;

If the entity is a corporation, the bond must be issued in the corporate name and any business name(s) used.

(5) If at any time, an entity amends, deletes, or adds a business name, the Agency must be notified within 30 days of the date of the change; a bond rider must be provided indicating the name change within that 30 days.

(6) If an entity registers as an individual, partnership, or corporation, and seeks to change the registered entity to one of the other types, the application must be accompanied by a new bond. Riders to existing bonds changing the type of entity bonded will be construed as a cancellation of the bond and will not be otherwise accepted.

(7) If a claim is filed against a registrant while the security required under ORS 701.085 or 701.095 is in effect, the security shall be held until final disposition of the claim.

(8) In lieu of a surety bond, a builder may file, under the same terms and conditions as when a bond is filed, an "Agreement with Depositor and Trustee" on a form prescribed by the Agency, evidencing assignment to the Agency of the right to determine the disposition of cash or federal government securities deposited with the trustee. Such a cash or federal government security deposit, placed in trust in a commercial bank, savings and loan association, mutual savings bank or credit union insured by the National Credit Union Administration authorized to do business in Oregon shall be the only form of security in lieu of a surety bond acceptable to the Agency under ORS 701.095.

(9) Any "Agreement with Depositor and Trustee" accepted by the Agency under ORS 701.095 shall remain in effect for not less than one year following termination, revocation, or expiration of the builder's registration except as provided in sections (10) and (11) of this rule.

(10) An "Agreement with Depositor and Trustee" may be released if it is first replaced by a surety bond having an effective date no later than the first day of the registration period in effect one year before the date of release.

(11) The funds or securities in trust under an "Agreement with Depositor and Trustee" must remain in the financial institution in which they were originally deposited as security until:

(a) The time specified in section (9) of this rule; or

(b) They are replaced with a surety bond as set forth in section (10) of this rule; or

(c) They are replaced by an "Agreement with Depositor and Trustee" from a different financial institution.

(12) Funds or securities deposited under an "Agreement with Depositor and Trustee" may be transferred from one account to another within the same financial institution, or other securities may be substituted for those initially deposited if the Agency is immediately sent notice of the transfer or substitution. Notice shall consist of a revised "Agreement with Depositor and Trustee" or a letter listing the new account number(s) or the substituted securities.

(13) The surety bond and the "Agreement with Depositor and Trustee" in lieu of the surety bond are for the exclusive purpose of payment of final orders of the Agency, issued under ORS 701.085(1), when such orders are not promptly paid by the registrant.

(14) The name of the entity as it appears on the "Agreement with Depositor and Trustee" shall follow the same format as that required for surety bonds under section (3) of this rule.

(15) If a registrant chooses to meet the requirements of ORS 701.085 by providing a combination security deposit and bond and if claims are adjudicated against the registrant, payment to claimants will first be made from the security deposit. Any unpaid balance will then be referred to the registrant's surety company for payment.

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Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 5, f. 6-15-76, ef. 7-1-76, 1BB 7, f. & ef. 11-14-77, 1BB 1-1978, f. & ef. 5-23-78; 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1982, f. 3-31-82, ef. 4-1-82; 1BB 1-1983, f. & ef. 3-1-83, Renumbered from 812-11-030; 1BB 2-1983, f. & ef. 7-6-83; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

Renewal of Registration

812-03-025 (1) A Certificate of Registration may be renewed upon application if the fee prescribed in rule 812-03-000(8) is paid and if it appears to the Agency that the security required in ORS 701.085 is in effect, by receipt by the Agency of either a new bond or a continuation certificate for the existing bond; or that the security required in ORS 701.095 is in effect; and if the applicant has complied with the provisions of rules 812-03-000(6) and 812-03-015(2).

(2) The term of each renewal shall be one year. Payments of fees in excess of the amounts required by section (1) of this rule shall be refunded.

(3) If during a work period the amount of a surety bond or deposit is changed and a claim is filed relating to work performed during that work period, the claimant may recover from the surety bond or deposit up to the amount in effect at the time the contract was entered into. However, any recovery is subject to the priorities set forth in ORS 701.150.

(4) A registrant may, at the time of renewal of a certificate of registration, reduce the bond or deposit to $2,000 upon certification that the registrant's gross business income during the previous 12 months from work subject to ORS Chapter 701 was less than $30,000. This may be accomplished by submission of a decrease rider to an existing bond or the submission of a new bond. If the decrease rider or new $2,000 bond is not received by the Agency within 30 days of the registrant's renewal date, the registrant will be renewed on the basis of the existing $5,000 bond, the decrease rider or new $2,000 bond will be returned to the bonding company and the bonding company and the registrant will be notified that the existing $5,000 bond will be liable unless a cancellation notice is received. The effective date on either the decrease rider or the new bond must be the registration renewal date or up to 30 days following the renewal date. A registrant is ineligible for this reduced amount if the certificate of registration was inactive for more than 2 of the previous 12 months. In addition, the Agency may refuse to authorize a reduced amount until any pending claims against the registrant are resolved.

(5) If a registrant provides a decrease rider to an existing bond or a new $2,000 bond in accordance with section (4) of this rule and if the effective date of the decrease rider or the new bond is before the registration renewal date, the Agency will determine the effective date to be the date it is received by the Agency or the effective date of the rider, whichever is later. If this determination still does not constitute an effective date which is the registration renewal date or after, the decrease rider or $2,000 bond will be returned to the bonding company, and the bonding company and the registrant will be notified that the existing $5,000 bond will be liable unless a cancellation notice is received.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 7, f. & ef. 11-14-77, 1BB 1-1978, f. & ef. 5-23-78; 1BB 3-1980(Temp), f. 6-2-80, ef. 7-1-80; 1BB 4-1980, f. & ef. 7-14-80, 1BB 5-1980, f. & ef. 10-7-80; 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1982, f. 3-31-82, ef. 4-1-82, 1BB 4-1982, f. & ef. 10-7-82, 1BB 1-1983, f. & ef. 3-1-83, Renumbered from 812-11-035, 1BB 3-1983, f. 10-5-83, ef. 10-15-83

[ED. NOTE: The text of Temporary Rules is not printed in the Oregon Administrative Rules Compilation. Copies may be obtained from the adopting agency or the Secretary of State.]

Revocation or Suspension of Registration

812-03-030 (1) For purposes of ORS 701.135 and this rule, a "registrant or applicant" shall include the owner, individual partners (including joint venturers), or individual corporate officers who make application to register or subsequently operate the individual proprietorship, partnership (joint venture), or corporation as well as the individual proprietorship, partnership (joint venture), and corporation.

(2) If the Agency adjudges one or more claims against an individual proprietorship, partnership (joint venture), or corporation which that entity or that entity's bond or security deposit fails to pay in full, the Agency will take the following action:

(a) Except as set forth in subsection (2)(d) of this rule, if the entity's registration is still active, the Agency will suspend the registration until the amounts adjudged against the entity have been paid. Upon full payment, the Agency may require the entity to provide a bond or security deposit in an amount three times that normally required;

(b) Except as set forth in subsection (2)(d) of this rule, if the entity's registration has lapsed, expired, or been terminated, the Agency will refuse to reinstate the registration until the amounts adjudged against the entity have been paid;

(c) Except as set forth in subsection (2)(d) of this rule, if one or more of the individuals comprising the first entity make application to reregister as another entity, the Agency may refuse to issue a new registration until the amounts adjudged against the first entity have been paid;

(d) The Agency may not take the actions outlined in this section if the entity submits proof to the Agency that the amounts adjudged against the entity represent debts discharged in bankruptcy or otherwise provided for by an approved plan of bankruptcy reorganization.

(3) Conduct as a builder that is dishonest or fraudulent, and which the Agency finds injurious to the welfare of the public includes, but is not limited to, the following:

(a) Acting in a manner that, because of a wrongful or fraudulent act by the applicant or registrant as a builder, has resulted in injury or damage to another person; or

(b) Failing to pay monies when due for materials or services rendered in connection with the applicant's or registrant's operations as a builder when the applicant or registrant has received sufficient funds as payment for the particular construction work project or operation for which the services or materials were rendered or purchased; or

(c) Accepting payment in advance on a contract or agreement and failing to perform work or provide services required by the contract or agreement and failing to return the payment; or

(d) Giving false, misleading or deceptive advertising whereby a reasonable person could be mislead or injured; or

(e) Submitting an application for registration that includes false or misleading information;

(f) Submitting a false gross business volume certification in order to qualify for a reduced bond amount as set forth in rule 812-03-025(4).

(4) If the Agency determines that a registration should be suspended or revoked, it will take one of the following actions:

(a) Propose to suspend or revoke the registration at some specific future date:

(A) The Agency will give notice to the registrant of its proposed action. This notice will be served personally or by certified mail and will include those items set forth in OAR 137-03-001. If the Agency proposes to suspend the registration, the notice will also include the length of the suspension and the conditions under which the suspension will be removed. If the Agency proposes to revoke the registration, the notice will explain that the revocation will be permanent and that the registrant will be barred from any future registration with the [illegible]ency.

(B) The notice will include information about an Agency-initiated hearing, if any, or will give the registrant an opportunity to request a hearing. Requests for hearings involving a proposed suspension or revocation must be received by the Agency within 20 days from the date the notice is mailed or personally served upon the registrant. If the Agency initiates a hearing, the notice will include the date, time, and location of the hearing, and a statement of the registrant's rights in a contested case before the Builders Board.

(b) Immediately suspend a registration upon determination that there is a serious danger to the public health or safety:

(A) The Agency will give notice to the registrant that the registration is suspended as of the date of the notice. This notice will be served personally or by certified mail and will include those items set forth in OAR 137-03-010. The notice will include the length of the suspension and the conditions under which the suspension will be removed.

(B) The notice will include information about an Agency-initiated hearing, if any, or will give the registrant an opportunity to request a hearing. Requests for hearings involving immediate suspensions must be received by the Agency within 90 days from the date the notice was mailed or personally served upon the registrant. If the Agency initiates a hearing, the notice will include the date, time, and location of the hearing, and a statement of the registrant's rights in a contested case before the Builders Board.

(5) If the Agency refuses to issue or reissue a registration, it will take the following action: Give notice to the applicant. This notice will be served personally or by certified mail and will include the following items:

(a) A statement of the party's right to hearing;

(b) A statement of the authority and jurisdiction under which the hearing will be held;

(c) A reference to the particular sections of the statutes [illegible] rules involved;

(d) A clear and concise statement of the reasons for the refusal;

(e) A statement that the applicant may be represented by counsel at the hearing;

(f) A statement that requests for hearings must be received by the Agency within 60 days from the date the notice was mailed or personally served upon the applicant.

(6) The Agency will enter a default order supporting its action and will enter into the record evidence demonstrating a prima facie case justifying the order if:

(a) It determines that it should suspend, revoke, or refuse to issue a registration in accordance with sections (4) and (5) of this rule; and

(b) The registrant or applicant has been given an opportunity to request a hearing and fails to do so within the specified time; or

(c) The registrant or applicant requests a hearing and fails to appear; or

(d) The Agency has scheduled a hearing of its own volition and the registrant or applicant fails to request a change of the hearing date and fails to appear.

(7) If the registrant or applicant timely requests a hearing relating to actions set forth in sections (4) and (5) of this rule, a notice of hearing will be served personally or by certified mail in accordance with ORS 183.413 and ORS 183.415. Based upon evidence received at the hearing, the Agency shall issue a final order including findings of fact and conclusions of law.

(8) A final order of the Builders Board relating to a suspension, revocation, or refusal to issue a registration may be appealed by filing a petition for judicial review with the Court of Appeals.

(9) Each hearing record will include a tape recording of the proceeding. Duplicate tape recordings may be purchased for $10 per tape. Tape recordings of Agency hearings will not be retained more than 30 days beyond the end of the 60-day appeal period following issuance of the Agency's final order except when petition for judicial review to the Court of Appeals has been timely filed.

Stat. Auth.: ORS Ch. 701

Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 1-1978, f. & ef. 5-23-78; 1BB 6-1980, f. & ef. 11-4-80; 1BB 5-1981(Temp), f. 12-30-81, ef. 1-1-82; 1BB 1-1982, f. 3-31-82, ef. 4-1-82; 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-040; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

[ED. NOTE: The text of Temporary Rules is not printed in the Oregon Administrative Rules Compilation. Copies may be obtained from the adopting agency or the Secretary of State.]

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DIVISION 4

CLAIMS

Types of Claims

812-04-000 (1) As used in ORS Chapter 701 and to determine priorities with regard to the security:

(a) An "employe claim" is a claim for unpaid wages filed by a laborer employed by a registrant to perform work subject to ORS Chapter 701;

(b) A "material claim" is a claim filed by a supplier who has not been paid for materials sold to a registrant to be used and installed in a structure. An "equipment claim" is a claim filed by a supplier who has not been paid for equipment fabricated into a structure (for example, air conditioning equipment) or for the rental of equipment to a registrant to be used in the performance of the work of a builder in connection with a structure. A claim may not be made for non-payment for tools sold to a registrant, for equipment sold to a registrant and not fabricated into a structure, or for interest or service charges on an account;

(c) A "subcontractor claim" is a claim filed by a subcontractor arising out of a contract between the subcontractor and a general contractor. Such a claim may be for unpaid labor and/or materials furnished under the contract;

(d) A claim filed by an owner for "breach of contract, negligent work, or improper work" may include, but not be limited to, one or more of the following:

(A) Failure of a registrant to meet contractual obligations imposed by a contract to perform work subject to ORS Chapter 701,

(B) Negligent or improper work by the registrant,

(C) Monies paid by the owner of a structure to prevent the filing of one or more construction liens resulting from failure by the registrant to pay for labor performed upon and/or materials and equipment furnished to a structure when the owner has already paid the registrant.

(e) A "construction lien claim" is a claim filed by an owner against a general contractor to discharge or to recoup funds expended in discharging a construction lien. The owner must have paid the general contractor for the work and a lien must have been filed because of failure to pay a subcontractor and/or material or equipment supplier for that person's contribution toward completion of the project. A construction lien claim may not include excess interest paid as the result of the owner's inability to refinance at a lower interest rate due to the existence of the lien;

(f) A "general contractor" claim is a claim by a registered contractor against a registered subcontractor. A general contractor claim is limited to damages which have resulted from one or more of the following actions by the subcontractor with whom the general contractor had a contractual relationship:

(A) Failure to meet contractual obligations imposed by a contract to perform work subject to ORS Chapter 701.

(B) Negligent or improper work.

(C) Failure to pay for labor performed upon and/or materials or equipment furnished to a project, causing one or more construction liens to be filed against the property.

(2) For purposes of payment from the bond or deposit as set forth in ORS 701.150(2):

(a) Claims defined in subsections (1)(d) and (e) of this rule constitute "claims filed against a builder by the owner of a structure";

(b) Claims defined in subsections (1)(a), (b), (c), and (f) of this rule constitute "all other types of claims";

(c) As set forth in ORS 701.150(2)(b), payment from any one security for all claims of the types defined in subsections (1)(a), (b), (c) and (f) of this rule shall not exceed $2,000, regardless of the amount of the security.

Stat. Auth.: ORS Ch. 183 & 701
Hist.: IBB 5, f. 6-15-76, ef. 7-1-76; IBB 1-1978, f. & ef. 5-23-78; IBB 6-1980, f. & ef. 11-4-80 IBB 3-1981, f. 10-30-81, ef. 11-1-81; IBB 1-1982, f. 3-31-82, ef. 4-1-82; IBB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-045; IBB 3-1983, f. 10-5-83, ef. 10-15-83

Filing of Claims

812-04-005 (1)(a) Claims will be accepted only against registered entities;

(b) If a claim is for breach of contract, negligent work, or improper work filed by an owner, the entity against whom the claim is filed will be considered registered and the claim will be accepted if that entity was registered during all or part of the work period;

(c) If a claim is a construction lien claim, an employe claim, a subcontractor claim or a material or equipment claim, the entity against whom the claim is filed will be considered registered and the claim will be accepted if one or more of the invoices or payroll records involve work performed or a debt incurred while the entity was registered. However, damages will be awarded only for those invoices or payroll records that fall within the period of registration;

(d) If a claim is a general contractor claim or a subcontractor claim, the entity against whom the claim is filed must meet the criteria set forth in subsections (1)(b) and (c) of this rule before the claim will be accepted. The claimant must have been registered at the time the bid was made or the contract was entered and continuously throughout the work period before the claim will be accepted.

(2) Claims submitted to the Agency pursuant to ORS 701.145 shall be deemed to have been filed when a Statement of Claim in substantial compliance with rule 812-04-025 is received by the Agency.

(3) Claims will be accepted only when a direct contractual relationship or an employment relationship exists between claimant and registrant.

(4) Claims will be accepted only for work performed within the boundaries of the State of Oregon or for materials or equipment supplied or rented for fabrication into or use upon structures located within the boundaries of the State of Oregon.

Stat. Auth.: ORS Ch. 183 & 701
Hist: IBB 5, f. 6-15-76, ef. 7-1-76; IBB 1-1978, f. & ef. 5-23-78; IBB 1-1979, f. & ef. 7-25-79; IBB 6-1980, f. & ef. 11-4-80 IBB 3-1981, f. 10-30-81, ef. 11-1-81; IBB 1-1982, f. 3-31-82, ef. 4-1-82; IBB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-050; IBB 3-1983, f. 10-5-83, ef. 10-15-83

Timeliness Requirements for Filing Claims

812-04-010 [IBB 6-1980, f. & ef. 11-4-80;
IBB 3-1981, f. 10-30-81, ef. 11-1-81;
IBB 1-1982, f. 3-31-82, ef. 4-1-82;
IBB 1-1983, f. & ef. 3-1-83;
Renumbered from 812-11-052;
Repealed by IBB 3-1983, f. 10-5-83, ef. 10-15-83]

Contracts With Arbitration Agreements

812-04-015 (1) The Agency will take the following action if a claim is received which is based upon a contract which contains an agreement by the parties to arbitrate disputes arising out of the contract:

(a) Inform the claimant that the Agency will accept the claim for processing only if both parties agree to waive their right to arbitration. This waiver must be written and signed by both parties and must be received by the Agency within 30 [illegible] of the date the Agency notifies the claimant that a waiver [illegible]quired

(A) If the Agency receives no response within 30 days to its request for a waiver from the claimant, the claim will be closed and will not be reopened.

(B) If the Agency receives no response within 30 days to its request for a waiver from the builder, the Agency will resume processing the claim.

(b) If the claimant is unable to locate the builder after making a diligent attempt to do so and submits to the Agency a written statement to that effect, including a description of the efforts made to locate the builder, the Agency will resume processing the claim;

(c) If the builder refuses to waive the right to arbitration as set forth in the contract, the Agency will discontinue processing the claim for 60 days to allow the builder time to commence arbitration. If the builder fails to submit evidence to the Agency that arbitration has been commenced within this 60-day period, the Agency will resume processing the claim;

(d) If arbitration is commenced and the builder submits evidence substantiating this within the 60-day period referred to in subsection (1)(c) of this rule, the Agency will discontinue processing the claim until the arbitration is completed. The claim file will remain open and the claimant's potential access to the builder's bond or security deposit will be retained if the claimant takes the following action:

(A) Within six months of the date on which the Agency discontinued processing the claim and no less frequently than every sixth month thereafter, delivers to the Agency a written report setting forth the current status of the arbitration proceeding, and

(B) Within 30 days of the date of final action by the arbitrator, delivers to the Agency a copy of the arbitration a[illegible]d or decision.

[illegible]C) If the claimant fails to comply with paragraph (1)(d)(A) and (B) of this rule, the Agency may close the claim file. A claim file closed in this manner will not be reopened.

(2) If the claimant is unsuccessful in obtaining an arbitration award upon completion of arbitration, the claim will be closed.

(3) If the claimant is successful in obtaining an arbitration award, the Agency will resume processing the claim. Any monetary damages awarded the claimant will be based upon the amount of the arbitration award.

Stat. Auth. ORS Ch. 701
Hist 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1982, f. 3-31-82, ef. 4-1-82; 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-0[illegible]3

Court Judgments

812-04-020 (1) A court judgment may constitute the basis for a claim in the following situations:

(a) A claimant has obtained a court judgment against a builder before filing a statement of claim;

(b) A claimant filed a previous claim which was closed in accordance with rule 812-04-050(3) because the claimant had also initiated litigation against the builder, and the litigation resulted in a judgment in favor of the claimant;

(c) A claimant has filed a claim which the Agency ceased processing in accordance with rule 812-04-050(4) until litigation initiated by the builder against the claimant was completed, and the litigation resulted in a judgment in favor of the claimant;

(d) A claimant has filed a claim which the Agency ceased processing because of its nature and complexity in accordance with rule 812-04-050(5), the claimant pursued the matter th[illegible]h the courts, and the litigation resulted in a judgment in fa[illegible] of the claimant.

(2) A court judgment will constitute the basis for a claim only if it involves work performed, material supplied or equipment rented within the jurisdiction of ORS Chapter 701.

(3) If a judgment is the basis for either a material claim, an equipment claim, or a subcontractor claim as defined in rule 812-04-000, and if the claim falls within the categories set forth in subsections (1)(a) and (b) of this rule, the claim must be filed within one year from the date the debt is incurred. The date on each invoice will constitute the date the debt was incurred. Any invoice received more than one year after the debt was incurred will be subtracted from the judgment in the event monetary damages are awarded. If the judgment is the basis for a breach of contract claim filed by an owner, as defined in rule 812-04-000, and if the claim falls within the category set forth in subsections (1)(a) and (b) of this rule, the date the claim is received must be one year or less from the date of occupancy (if a new structure) or within one year or less from the date the work was substantially completed (if an existing structure). If the judgment is the basis for a general contractor claim as defined in rule 812-04-000, and if the claim falls within the category set forth in subsections (1)(a) and (b) of this rule, the date the claim is received must be one year or less from the date the subcontractor substantially completed the work or, if the work was not substantially completed, from the date the subcontractor ceased working. If the claim falls within the categories set forth in subsections (1)(c) and (d) of this rule, the claim will be considered timely filed if the claimant submits the judgment to the Agency within 30 days of the date of final action by the court as set forth in rule 812-04-050.

(4) Claims based on court judgments may include attorney fees, court costs, interest and/or service charges if these items are included as part of a court judgment.

(5) Upon receipt of a timely-filed judgment, the Agency will take one of the following actions:

(a) Issue a proposed order providing the builder and the claimant with an opportunity to request a hearing within 20 days of the date of mailing the proposed order;

(b) Schedule an administrative hearing.

(6) The Agency's adjudication of a claim based upon a court judgment will involve only a determination of whether the work performed or the materials purchased come within the jurisdiction of the Builders Board.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 1-1982, f. 3-31-82, ef. 4-1-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-054; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

Form of Claims

812-04-025 (1) Claims shall be submitted on Statement of Claim forms provided by the Agency. The Agency may require the use of the most recent revision of the Statement of Claim form.

(2) The Agency may require the following information before processing employe claims; subcontractor claims; claims for breach of contract, negligent work, or improper work filed by an owner; construction lien claims; and general contractor claims:

(a) The name, address, and telephone number of the claimant;

(b) The name, address, telephone number, and registration number of the registrant;

(c) The amount claimant alleges to be due from the registrant after crediting payments, offsets, and counterclaims in favor of the registrant to which claimant agrees;

(d) Identification of the type of claim;

(e) The date on which the contract was entered into; if the contract was in writing, a copy of the contract shall be attached to the Statement of Claim;

(f) Job location;

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(g) Dates on which work began and ceased;

(h) Payments, offsets, and counterclaims of the builder, if known;

(i) Whether the project is residential or commercial/industrial;

(j) A certification by the claimant that the Statement of Claim is true;

(k) If the matter which is the subject of a Statement of Claim has, before the filing of the Statement of Claim, been adjudicated by a court or by binding arbitration, the Statement of Claim shall be accompanied by a copy of the judgment and a copy of the complaint or other pleading upon which the judgment is based or by a copy of the arbitration award;

(l) Claims alleging non-payment for labor and/or labor and materials filed by a subcontractor shall be accompanied by two copies of each original invoice relating to the claim and a recapitulation showing the date, number, amount and description of each invoice submitted. Claims alleging non-payment for labor filed by an employe shall be accompanied by two copies of time cards or other evidence of time worked;

(m) Claims filed by an owner to recoup funds expended to prevent the filing of a construction lien shall be accompained by a copy of the notice of right to lien, if any;

(n) Construction lien claims shall be accompanied by evidence that the claimant has paid the general contractor, a copy of the notice of right to lien, the lien, and any foreclosure documents;

(o) If the lienholder of lien claimant in those claims referred to in subsections (2)(m) and (n) of this rule is a subcontractor, the claim shall be accompanied by a copy of each invoice or billing included in the lien. If the lienholder or lien claimant in those claims referred to in subsections (2)(m) and (n) of this rule, is a material and/or equipment supplier, the claim shall be accompanied by a recapitulation of the date, number, and amount of each invoice included in the lien and a copy of each invoice.

(3) The Agency may require the following information before processing claims for non-payment of materials and/or equipment:

(a) The claimant's business name, the name and position or title of the person completing the Statement of Claim, the claimant's mailing address, and the claimant's telephone number;

(b) The name, address, telephone number, and registration number of the registrant;

(c) Whether the materials and/or equipment were used in Oregon for residential and/or commercial and industrial buildings;

(d) The job site addresses where the materials and/or equipment were delivered;

(e) The beginning and ending dates of the invoices;

(f) A recapitulation of the indebtedness showing the date of each invoice, each invoice number, and each invoice amount;

(g) The amount claimant alleges to be due from the registrant after crediting payments and deducting amounts included on the invoices for tools, interest, and/or service charges;

(h) A certification by the claimant that the Statement of Claim is true;

(i) If the matter which is the subject of the Statement of Claim has, before the filing of the Statement of Claim, been adjudicated by a court or by binding arbitration, the Statement of Claim shall be accompanied by a copy of the judgment and a copy of the complaint or other pleading upon which the judgment is based or by a copy of the arbitration award. If a construction lien has been filed relating to the debt which is the subject of the Statement of Claim, the Statement of Claim shall be accompanied by a copy of the construction lien and/or any foreclosure documents;

(j) The Statement of Claim shall be accompanied by two copies of each invoice listed on the recapitulation.

Stat. Auth. ORS Ch. 701
Hist: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 7, f. & ef. 1-14-77; 1BB 1-1978, f. & ef. 5-23-78; 1BB 1-1979, f. & ef. 7-25-79; 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-055; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

Construction Lien Claims

812-94-030 (1) Upon acceptance of a claim, the Agency shall send a copy of the claim to the general contractor and may initiate an investigation to determine the validity of the claim:

(a) Investigation by the Agency will include:

(A) A determination of whether the claimant paid the general contractor for work performed or materials supplied or equipment rented subject to ORS Chapter 701 and whether the general contractor failed to pay the subcontractor or material or equipment supplier, thereby causing a lien to be filed against the claimant's property, and

(B) A determination of whether the lienholder delivered to the claimant a "Notice of the Right to Lien" as specified in ORS 87.018, 87.021, and 87.025, and

(C) A determination of whether the lienholder filed the lien with the recording officer of the county as specified in ORS 87.035.

(b) If the general contractor contends that payment has been made to the lienholder — either directly or by the return of goods constituting a credit to the registrant's account — the general contractor may subpoena the lienholder and pertinent records to any hearing held by the Agency.

(2) If more than one lien has been filed against the claimant's property, a separate Statement of Claim shall be submitted for each lien filed.

(3) The claimant may seek monetary damages in the amount the claimant has paid to discharge the lien or, if the claimant has not paid to discharge the lien, in the amount of the lien.

(4) Claims may include attorney fees, court costs, interest and/or service charges if these items are included as part of the construction lien.

(5) The Agency may reduce the amount awarded to the claimant by:

(a) Any amount the claimant owes the general contractor;

(b) The amount of the debts incurred during any period of nonregistration of the general contractor;

(c) Any amount included for tools or equipment not fabricated into the structure.

(6) If the amount due and unpaid to the general contractor is greater than the amount of the lien, the claim will be dismissed.

(7) If a claimant files two or more claims against a general contractor relating to work performed under the same contract(s) and if the claimant has not paid the general contractor the full amount of the contract, the amount awarded on each claim will be reduced on a pro rata basis:

(a) No proposed or final orders shall be issued on any claim until all claims involving the two parties filed within the same 90-day period have reached identical stages in their processing;

(b) The amount awarded on each claim shall be reduced by a prorated portion of the amount due on the contract.

(8) If a suit is filed to enforce a lien that is the subject of a claim, the agency shall send notice to the claimant that:

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(a) The claimant has the right to request a stay of the proceedings until the agency's processing of the claim is complete;

(b) The agency will hold the claim open for 60 days from the date of the notice to allow the claimant to obtain a stay

(c) The Agency will close the claim if evidence is not received within 60 days from the date of the notice that a stay has been obtained;

(d) Upon timely receipt of evidence that a stay has been obtained, the Agency will resume processing the claim.

(9) If at any time during the processing of the claim, the claimant accepts a promissory note from the general contractor as settlement of the claim, the Agency will dismiss the claim. The Agency will consider that the claimant, by accepting the promissory note, has chosen another forum for resolution of the claim. Dismissal of the claim will be final, and the claim will not be reopened.

Stat. Auth.: ORS Ch. 701
Hist: IBB 3-1981, f. 10-30-81, ef. 11-1-81; IBB 1-1982, f. 3-31-82, ef. 4-1-82; IBB 4-1982, f. & ef. 10-7-82; IBB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-061; IBB 2-1983, f. & ef. 7-6-83; IBB 3-1983, f. 10-5-83, ef. 10-15-83

Claims Filed by Owners for Breach of Contract, Negligent Work, or Improper Work

812-04-035 (1) Upon acceptance of a claim, the Agency shall send a copy of the claim to the registrant and may initiate an investigation to determine the validity of the claim. The investigation may include an on-site inspection.

(2) If it appears that the registrant has breached a contract or performed work negligently or improperly, the Agency may recommend to the claimant and registrant a resolution consistent with the terms of the contract, generally accepted building practices, and industry standards.

(3) A settlement proposal may be presented by the Agency to the claimant and registrant for their consideration and agreement:

(a) If claimant and registrant agree to the resolution recommended by the Agency and sign the settlement agreement, the agreement shall be binding upon each party unless breached by the other;

(b) The Agency may close the claim file without notice to the claimant if:

(A) The claimant notifies the Agency that the terms of the settlement agreement have been fulfilled, or

(B) The claimant does not notify the Agency in writing, within 30 days of the date shown on the settlement agreement for completion, that the terms of the settlement agreement have not been fulfilled.

(4) If at any time during the processing of the claim the Agency finds that the issues involved in the claim have been submitted to a court for determination, or to arbitration, or to any entity authorized by law or the parties to effect a resolution, it may discontinue processing the claim.

(5) If at any time during the processing of the claim the Agency finds that the nature or complexity of the issues are such that a court would be a more appropriate forum for adjudication, it may discontinue processing the claim.

(6) If at any time during the processing of the claim, the claimant accepts a promissory note from the registrant as settlement of the claim, the Agency will dismiss the claim. The Agency will consider that the claimant, by accepting the promissory note, has chosen another forum for resolution of the claim. Dismissal of the claim will be final, and the claim will not be reopened.

(7) If the registrant is willing to attend an on-site inspection conducted by a representative of the Agency and the claimant [illegible] not permit the registrant to attend, the Agency may dismiss the claim.

(8) If the registrant is willing to comply with the resolution recommended by the Agency under section (2) of this rule and the Agency finds that the registrant is capable of complying, but the claimant will not permit the registrant to comply, the Agency may dismiss the claim.

(9)(a) The claimant may seek monetary damages if:

(A) The Agency has not discontinued processing the claim, and

(B) The claimant disagrees with the resolution recommended by the Agency, or

(C) The registrant cannot or will not comply with the recommended resolution, or

(D) The parties signed the settlement agreement proposed by the Agency but, through no fault of the claimant, the terms of the settlement agreement have not been fulfilled by the builder, and the Agency is so advised in writing by the claimant within 30 days of the date shown on the settlement agreement.

(b) To seek monetary damages, the claimant shall state an amount alleged to be due and owing from the registrant, limited to items of complaint in the Statement of Claim. The Agency may require a claimant to submit, in support of the amount alleged, an estimate from a registrant for the cost of correction of the items of complaint.

(10) If upon investigation of a claim it appears to the Agency that the registrant has breached a contract or performed work negligently or improperly, but that the monetary value of damages sustained by the claimant is less than any amount due and unpaid to the registrant from the claimant under the terms of the contract, the Agency may dismiss the claim.

(11) If upon investigation of a claim it appears to the Agency that the registrant has not breached a contract or performed work negligently or improperly, the Agency may dismiss the claim.

(12) If the Agency dismisses a claim under sections (10) or (11) of this rule, the claimant may contest the dismissal by stating an amount alleged to be due and owing from the registrant and requesting a hearing, within 20 days of the date of dismissal. The hearing will be conducted as set forth in rule 812-04-055.

Stat. Auth.: ORS Ch. 701
Hist: IBB 5-1980, f. & ef. 11-4-80 IBB 3-1981, f. 10-30-81, ef. 11-1-81; IBB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-062; IBB 3-1983, f. 10-5-83, ef. 10-15-83

General Contractor Claims

812-04-040 (1) Upon receipt of a general contractor claim, the Agency shall send a copy of the claim to the subcontractor and may initiate an investigation to determine the validity of the claim. The investigation may include an on-site inspection.

(2) If at any time during the processing of the claim, the Agency finds that the issues involved in the claim have been submitted to a court for determination or to arbitration or to any entity authorized by law or the parties to effect a resolution, it may discontinue processing the claim.

(3) If at any time during the processing of the claim, the Agency finds that the nature or complexity of the issues are such that a court would be a more appropriate forum for adjudication, it may discontinue processing the claim.

(4) If at any time during the processing of the claim, the general contractor accepts a promissory note from the subcontractor as settlement of the claim, the Agency will dismiss the claim. The Agency will consider that the general contractor, by accepting the promissory note, has chosen another forum for resolution of the claim. Dismissal of the claim will be final, and the claim will not be reopened.

(5) If upon investigation of a claim, it appears to the Agency that the subcontractor has not breached a contract or

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performed work negligently or improperly, the Agency may dismiss the claim.

(6) An award of monetary damages against a subcontractor will be reduced by any amount due and unpaid from the general contractor to the subcontractor under the terms of the contract. If the amount due and unpaid to the subcontractor is greater than the amount of the award, the claim will be dismissed.

(7) If the Agency dismisses the claim under sections (2), (3), (4), (5), or (6) of this rule, the claimant may contest the dismissal by stating an amount alleged to be due and owing from the subcontractor and requesting a hearing within 20 days of the date of dismissal. The hearing will be conducted as set forth in rule 812-04-055.

(8) Payment from bonds or deposits resulting from monetary damages awarded for general contractor claims shall be made in accordance with priorities set forth in ORS 701.150.

(9) If a homeowner claim based on the same facts and issues is received at any time during the processing of the general contractor claim, the two claims will be processed together.

Stat. Auth.: ORS Ch. 701
Hist: 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-063; 1BB 3-1983, f. 10-5-83, ef. 10-15-83

Claims for Materials or Equipment and Labor

812-04-045 (1) Upon acceptance of a claim, the Agency shall send a copy of the claim to the registrant and may initiate an investigation to determine the validity of the claim. The investigation may include an on-site inspection.

(2) If it appears to the Agency that the amounts claimed are due from the registrant, it may accept the claimant's Statement of Claim and supporting documentation as evidence of the damages sought.

(3) If a construction lien claim relating to all or part of the debt that is the subject of a material claim, an equipment claim, or a labor claim is received by the Agency before, or during the processing of the material claim, equipment claim, or labor claims, the Agency shall do one of the following:

(a) Process the claims simultaneously; or

(b) Process the construction lien claim and withhold processing the material claim, equipment claim, or labor claim until adjudication of the construction lien claim is complete.

(4) If the circumstances set forth in section (3) of this rule exist and if the Agency awards monetary damages to the owner to discharge the lien, the Agency may reduce the amount of the award in the material, equipment, or labor claim by the amount of the award in the construction lien claim.

(5) If at any time during the processing of the claim it appears to the Agency that the issues involved in the claim have been submitted to a court for determination, or to arbitration, or to any entity authorized by law or the parties to effect a resolution, it may discontinue processing the claim.

(6) If at any time during the processing of the claim it appears to the Agency that the nature or complexity of the issues are such that a court would be a more appropriate forum for adjudication, it may discontinue processing the claim.

(7) If at any time during the processing of the claim, the claimant accepts a promissory note from the registrant as settlement of the claim, the Agency will dismiss the claim. The Agency will consider that the claimant, by accepting the promissory note, has chosen another forum for resolution of the claim. Dismissal of the claim will be final, and the claim will not be reopened.

(8) The claimant may seek monetary damages if the Agency has not discontinued processing the claim under sections (5), (6) and (7) of this rule.

(9) If it appears to the Agency that the amounts claimed are not due from the registrant, it may dismiss the claim. The claimant may contest the dismissal by requesting a hearing, within 20 days of the date of dismissal. The hearing will be conducted as set forth in rule 812-04-055.

Stat. Auth. ORS Ch. 701
Hist. 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-064

Determination of Claims Which the Agency has Refused to Continue Processing Under the Authority of ORS 701.145(1)(a) or (d)

812-04-050 (1) As used in this rule:

(a) "Claimant" means the entity which filed a claim with the Builders Board, against a registrant;

(b) "Voluntary" means that the action before the court or other entity was initiated or commenced by the claimant and was not in response to an action previously before the court or other entity initiated or commenced by the registrant against the claimant;

(c) "Involuntary" means that the action before the court or other entity was initiated or commenced by a person other than the claimant, including but not limited to, a suit to foreclose a lien, or a breach of contract complaint filed in a court of competent jurisdiction against the claimant.

(2) As used in this rule and in ORS 701.145(1)(d): "Nature and complexity" includes, but is not limited to the following meaning:

(a) Involves issues requiring legal interpretation of statutes in addition to ORS Chapter 701 (i.e. contract law, corporate law, etc.); or

(b) In the interest of fairness and equity, requires rulings against persons or entities outside the jurisdiction of the Agency.

(3)(a) The Agency may refuse to continue processing a claim under the authority of ORS 701.145(1)(a) and close the claim file if:

(A) Submission of the matter to a court or other entity has been voluntary, and

(B) The Agency has notified the claimant that closure of the claim file will bar the claimant from access to the surety bond or other security, and

(C) The claimant, having been so notified by the Agency, has not, within 20 days of such notification, withdrawn the matter from the court or other entity to which it was submitted.

(b) A claim file closed as set forth in this subsection shall not be reopened.

(4)(a) The Agency may refuse to continue processing a claim under the authority of ORS 701.145(1)(a), and later resume processing the claim if:

(A) Submission of the matter to a court or other entity has been involuntary, and

(B) The facts and issues under determination by the court or other entity are the same facts and issues contained in the original statement of claim filed with the Builders Board, and

(C) The claimant has, within six months of the date on which the Agency refused to further process the claim, and no less frequently than every sixth month thereafter, delivered to the Agency a written report setting forth the current status of the action before the court or other entity, and

(D) The claimant has, within 30 days of the date of final action by the court or other entity, delivered to the Agency a copy of the judgment or decision together with a copy of the complaint or other pleadings upon which the judgment or decision is based.

(b) If the claimant fails to comply with paragraphs (4)(a)(C) and (D) of this rule, or either of them, the Agency may, without notice to the claimant, close the claim file. A

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claim file closed as set forth in this subsection shall not be reopened.

(5)(a) The Agency may refuse to continue processing a claim under the authority of ORS 701.145(1)(d), and later resume processing the claim if:

(A) The claimant, within 90 days of refusal by the Agency to further process the claim, files an action in a court of competent jurisdiction relative to the same facts and issues contained in the original statement of claim filed with the Builders Board, and

(B) The claimant has, within 10 days of filing the action referred to in paragraph (5)(a)(A) of this rule, delivered a copy of that action to the Agency, and

(C) The claimant has, no less frequently than every sixth month after the filing of the action, delivered to the Agency a written report setting forth the current status of the action before the court, and

(D) The claimant has, within 30 days of the date of final action by the court, delivered to the Agency a copy of the judgment.

(b) If the claimant fails to comply with paragraphs (5)(a)(A), (B), (C), and (D) of this rule, or any of them, the Agency may, without notice to the claimant, close the claim file. A claim file closed as set forth in this subsection shall not be reopened.

(6) In addition to the requirements of paragraphs (4)(a)(C) and (D), and (5)(a)(B), (C), and (D) of this rule, the Agency may, at any time, demand from the claimant a current status report. Such demand shall be in writing, and sent to the claimant's last address known to the Agency. The claimant shall deliver a written response to the Agency within 30 days of the date the demand letter is mailed by the Agency, setting forth the current status of the action before the court or other entity. If a timely written response is not received by the Agency from the claimant, the Agency may, without notice to the claimant, close the claim file. A claim file closed as set forth in this section shall not be reopened.

(7) To "resume processing the claim" as used in sections (4) and (5) of this rule means to accept a judgment of a court of competent jurisdiction or a decision of another entity as the final determination of the merits of the claim. Upon receipt of such judgment or decision, the Agency shall issue its proposed order in the matter, and serve the proposed order on the parties. The proposed order shall be based upon the judgment or decision. Opportunity for hearing shall be given the parties; however, at such hearing the merits of the claim will not be readjudicated. Rights to file exception and to seek judicial review are as set forth in rule 812-04-060.

(8) This section applies only to claims closed or dismissed by the Board under the authority of ORS 701.145(1)(a) or (d) during the period from October 4, 1979, to November 4, 1980. With respect to such claims only, the claimant may, upon receiving a judgment from a court of competent jurisdiction, submit that judgment to the Agency. Provided that the facts and issues upon which the judgment is based are the same facts and issues which were the subject of the claim filed with the Builders Board, the Agency may then reopen the previously-closed claim file and proceed in the manner set forth in section (7) of this rule. Availability of redress through a bond or other security is subject to the bond or other security not having been previously exhausted. The provisions of section (6) of this rule apply.

Stat. Auth.: ORS Ch. 701
Hist.: 1BB 5, f. 6-15-76, ef. 7-1-76; 1BB 7, f. & ef. 11-14-77; 1BB 1-1978, f. & ef. 5-23-78; 1BB 3-1978, f. & ef. 12-4-78; 1BB 2-1980, f. & ef. 2-29-80; 1BB 6-1980, f. & ef. 11-4-80; 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-065

Adjudication of Monetary Damages by the Agency

812-04-055 (1) If the Agency determines that monetary damages should be considered, one of the following events will take place:

(a) A claimant will submit to the Agency an amount alleged to be due and owing from a registrant, in accordance with rule 812-04-035(9)(b); or

(b) A claimant will seek monetary damages as set forth in rule 812-04-045.

(2) The Agency may respond by doing either of the following:

(a) Issuing a proposed order, stating the amount claimed and giving opportunity for hearing; or

(b) Setting an administrative hearing to determine the validity of the claim and whether the amount claimed, or some lesser amount, is proper.

(3) If the Agency issues a proposed order and no written request for hearing is received by the Agency within 20 days of the date of mailing of the proposed order, the Agency may issue a final order as proposed.

(4) If the Agency issues a proposed order and a written request for hearing is timely received, the Agency will set an administrative hearing to determine the validity of the claim and whether the amount claimed, or some lesser amount, is proper.

(5) A notice of hearing shall state the amount being sought by the claimant. The Agency shall not issue a final order in an amount greater than that shown in the notice of hearing.

(6) "Determination of the validity of a claim" means determining:

(a) Whether the claim arose out of a transaction within the scope of ORS Chapter 701; or

(b) Whether the Agency has jurisdiction over the matter(s) at issue; and

(c) Whether the claimant has been damaged; and if so, whether those damages have been caused by the registrant, and if so, the monetary amount due the claimant because of those damages.

(7) Administrative hearings may be held before a hearings officer of the Agency. The claimant must prove that damages have occurred and that those damages have been caused by the registrant, and the monetary value of those damages. If the claimant fails to carry this burden of proof, the Agency will dismiss the claim.

(8) If the claimant proves that damages have occurred but fails to provide persuasive proof of the monetary value of those damages, the hearings officer will offer the parties three options:

(a) To continue the hearing until additional estimates can be obtained; or

(b) To allow the hearings officer to establish a monetary value of damages based upon the hearings officer's expertise; or

(c) To dismiss the claim due to the claimant's failure to carry the burden of proving the monetary value of the damages.

(9) If the claimant, after being properly served notice of hearing in accordance with rule 812-01-010(1), fails to appear at a hearing, the Agency will dismiss the claim unless it finds that failure to appear was caused by circumstances outside the control of the claimant.

(10) If the registrant, after being properly served notice of hearing in accordance with rule 812-01-010(1), fails to appear at a hearing, the Agency will issue a default order based upon the claimant's presentation of a prima facie case. The only exceptions will be those situations in which the registrant's failure to appear was caused by circumstances outside the registrant's control.

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DIVISION 5

CIVIL PENALTIES

Civil Penalties

812-05-090 (1)(a) If the Agency proposes to assess a civil penalty, it shall issue and serve on the respondent a proposed order, giving the opportunity for hearing;

(b) If the Agency issues a proposed order and no written request for hearing is received by the Agency within 20 days of the date of mailing the proposed order, the Agency may issue a final order as proposed;

(c) If the Agency issues a proposed order and a written request for hearing is timely received, the Agency will set an administrative hearing to determine whether the respondent has violated any provision of ORS Chapter 701 or of these rules, and if so, the amount of the civil penalty to be assessed;

(d) A notice of hearing shall contain the amount of the civil penalty proposed by the Agency. The Agency shall not issue a final civil penalty order in an amount greater than that shown in the notice of hearing.

(2) Administrative hearings may be held before a hearings officer of the Agency. The Agency's evidence may be entered into the record by the hearings officer, or by another representative of the Agency. If the respondent fails to appear at the hearing, nevertheless the Agency must present a prima facie case.

(3) Based on evidence received at the hearing, the hearings officer will prepare findings of fact and conclusions and make recommendations to the Agency for disposition of the case. The Agency, after review of the findings of fact and conclusions will issue a proposed order assessing a civil penalty in a specified amount or a final order dismissing the matter.

(4) The respondent may file written exceptions if the respondent does not believe the proposed order is supported by the evidence received at the hearing. To be considered, exceptions must be received by the Agency within 20 days of the date of mailing of the proposed order. If written exceptions are not timely received, the Agency may issue a final order as proposed.

(5) If exceptions are timely received, the matter will be set for consideration by the members of the Board at their next regular meeting, for which agenda space is available. Written argument in opposition to the proposed order will be accepted up to 15 days before the Board meeting date if the original exceptions were timely received.

(6) The respondent and/or the respondent's attorney may appear before the members of the Board to argue against the proposed order, if the Agency receives written notice of intent to do so not less than 15 days before the Board meeting date. Oral argument will be permitted only if the original exceptions were timely received.

(7) At the meeting of the members of the Board, the Board will consider evidence received at the hearing and exceptions and written or oral argument relative to the proposed order, but the Board will not consider new or additional evidence.

(8) The members of the Board may affirm the proposed order and findings of fact, modify either or both, or send the case back to a new hearing. Unless the case is sent back to a new hearing, the Agency will issue a final order after the Board meeting.

(9) Final orders are subject to judicial review as set forth in ORS Chapter 183.

(10) Time allowed for oral argument before the members of the Board may be limited to 10 minutes.

(11)(a) A final civil penalty order is due and payable when statutory appeals periods have passed;

(b) The Agency may initiate its own collection proceedings, assign the matter to the Department of Revenue for collection, or commence an action as set forth in ORS 701.992(3).

(12) The Agency may revoke the registration of any builder who fails to pay on demand a civil penalty which has become due and payable.

Stat. Auth. ORS Ch. 701
Hist: 1BB 7-1980(Temp), f. & ef. 11-4-80; 1BB 8-1980, f. & ef. 12-9-80; 1BB 2-1981, f. & ef. 6-4-81, 1BB 1-1982, f. 3-31-82, ef. 4-1-82, 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-080

[**ED. NOTE**: The text of Temporary Rules is not printed in the Oregon Administrative Rules Compilation. Copies may be obtained from the adopting agency or the Secretary of State.]

Schedule of Fines

812-05-005 The Agency may assess fines according to the following schedule:

(1) $600 for advertising in violation of ORS 701.055(1) and section 812-03-000(7), to be reduced to $200 if the respondent registers or to $50 if the advertisement is withdrawn immediately upon notification from the Agency that a violation has occurred and no work was accepted as a result of the advertisement; and

(2) $600 per offense without possibility of reduction for advertising in violation of ORS 701.155(1) and section 812-03-000(7), when one or more previous violations have occurred; and

(3) $1,000 per offense for performing work as a builder as defined in ORS Chapter 701 or these rules, to be reduced to $600 if the respondent registers within a specified time; and

(4) $1,000 per offense without possibility of reduction for performing work as a builder as defined in ORS Chapter 701 or these rules, when an owner has been damaged by the performance of that work; and

(5) $1,000 per offense without possibility of reduction for performing work as a builder as defined in ORS Chapter 701 or these rules, when one or more violations have occurred; and

(6) $500 per offense for failure to respond to the Agency's request for the list of subcontractors required in ORS 701.055(8); and

(7) $1,000 per offense for hiring a nonregistered subcontractor; and

(8) At the discretion of the Board, a warning or a fine in any amount up to $1,000 for failing to provide an "Information Notice to Owners about Construction Liens" as provided in ORS 87.093.

Stat. Auth.: ORS Ch. 701
Hist: 1BB 4-1982, f. & ef. 10-7-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-080(13); 1BB 3-1983, f. 10-5-83, ef. 10-15-83

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(11) Claimant or registrant may challenge and offer evidence to disprove the Agency's investigation report, if any, at an administrative hearing.

(12) Based upon evidence received at the hearing, the hearings officer will prepare findings of fact and conclusions and make recommendations to the Agency for disposition of the case. The Agency, after review of the findings of fact and conclusions, will issue a proposed order. The proposed order may order the registrant to pay monetary damages to the claimant, or dismiss the claim. The Agency may consider any amounts due and unpaid to the registrant from the claimant under the terms of the contract and may reduce any proposed award by that amount.

(13) The record of Agency hearings will include a tape recording of the proceeding. Tape recordings of Agency hearings may not be retained more than 30 days beyond the end of the 60-day appeal period following the issuance of the Agency's final order, except when petition for judicial review to the Court of Appeals has been timely filed.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1982, f. 3-31-82, ef. 4-1-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-067

Exceptions to Agency Orders

812-04-060 (1) Claimant or builder may file written exceptions if they believe the proposed order is not supported by evidence received at the hearing. To be considered, exceptions must be received by the Agency within 20 days of the date of mailing of the proposed order. If written exceptions are not timely received, the Agency may issue a final order.

(2) If exceptions are timely received, the matter will be set for consideration by the members of the Board at their next regular meeting for which agenda space is available. Copies of exceptions filed will be mailed to the other side who may respond to the exceptions. Response and any written argument for or against the proposed order will be accepted up to 15 days before the Board meeting date if the original exceptions were timely received.

(3) Claimant and registrant, and/or their attorney(s), may appear before the members of the Board to argue for or against the proposed order if the Agency receives written notice of intent to do so not less than 15 days before the Board meeting date. Oral argument will be permitted only if the original exceptions were timely received.

(4) The Agency may waive the 15-day requirement contained in sections (2) and (3) of this rule.

(5) At the meeting of the members of the Board, the Board will consider evidence received at the hearing and exceptions and written or oral argument for or against the proposed order, but the Board will not consider new or additional evidence.

(6) The members of the Board may affirm the proposed order and findings of fact, modify either or both, or send the case back to a new hearing. Unless the case is sent back to a new hearing, the Agency will issue a final order after the Board meeting.

(7) Final orders are subject to judicial review as set forth in ORS Chapter 183.

(8) Time allowed for oral argument before the members of the Board may be limited to ten minutes for each side.

Stat. Auth.: ORS Ch. 183 & 701
Hist: 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1981, f. & ef. 3-11-81; 1BB 1-1982, f. 3-31-82, ef. 4-1-82; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-069

Closure of Claims

812-04-065 Throughout the processing of a claim, the claimant has the responsibility to pursue the claim and to respond in a timely manner to requests from the Agency for information or documentation. Failure of a claimant to respond to correspondence from the Agency, or to provide requested information or documentation within a time limit specified in that correspondence or request, may result in closure of the claim file by the Agency without further notice to the claimant.

Stat. Auth.: ORS Ch. 701
Hist: 1BB 6-1980, f. & ef. 11-4-80; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-072

Payment From Surety Bonds or Security

812-04-070 (1) At any time during the processing of a claim, if the Agency becomes aware of partial or full exhaustion of the surety bond or security by prior claims, it may notify the claimant and close the claim file, or it may process the claim to a final order and close the claim file.

(2) The Agency may notify the surety company of claims pending.

(3) The Agency shall notify the surety company of claims ready for payment. This notice shall constitute notice that payment is due on the claim. "Ready for payment" as used in this rule means that all of the following have occurred:

(a) A final order has been issued, and 30 days has elapsed to allow the registrant a reasonable time in which to pay the order;

(b) The Agency has received no evidence that the registrant has complied with the final order;

(c) The registrant has not requested a stay of the final order pending a review by the Court of Appeals;

(d) All other claims filed against the registrant within the same 90-day filing period under ORS 701.150 have either been resolved, been closed, or have reached the same stage of processing as the subject claim.

(4) If the registrant has provided an "Agreement with Depositor and Trustee" in lieu of a surety bond, the Agency shall direct the trustee to pay the claim from the deposit when the claim is ready for payment under this rule. Priorities set forth in ORS 701.150 will apply in all payments from surety bonds or deposits.

(5) If payment from a surety bond or deposit results from adjudication of a construction lien claim, payment shall be made jointly to the owner and lienholder.

Stat. Auth.: ORS Ch. 701
Hist: 1BB 6-1980, f. & ef. 11-4-80 1BB 3-1981, f. 10-30-81, ef. 11-1-81; 1BB 1-1983, f. & ef. 3-1-83; Renumbered from 812-11-075

BUILDERS BOARD REGISTRATION

DO I NEED TO REGISTER WITH THE BUILDERS BOARD?

You must register before you advertise, bid, perform work upon, or arrange for work to be performed upon a residence other than your own in the pursuit of an independent business. As a general rule, you should register with the Builders Board if you consider yourself either a prime contractor or a subcontractor.

Examples of the trades that must register with the Builders Board include:

Cabinet installers
Concrete workers
Countertop installers
Developers
Electricians
Excavators
Fence installers
Finish carpenters
Fireplace or wood-burning stove dealers and installers
Floorcovering dealers and installers
Framers
General contractors
Heating and cooling system installers
Housemovers
Masons
Mobile home installers
Painters
Plumbers
Roofers
Solar installers
Wallcovering installers
Weatherization contractors

NOTE: This is not a complete list.

You must register if you are building one or more residences speculatively. "Speculative" building means that you are building a residence that you plan to sell during or after construction.

If there is any question in your mind about whether or not you should register, you should contact the Builders Board.

If you are working or advertising as a builder and are not registered with the Builders Board, you could be fined up to $1,000. In addition, you may not file a suit or lien if someone fails to pay you for work you perform while not registered.

* * * * *

HOW DO I REGISTER?

To register with the Builders Board, you must do five things:

1. Register any assumed business name (or corporation) with the Corporation Division, 158 12th Street N.E., Salem, Oregon 97310; telephone 378-4166.
2. Complete the application in this packet.
3. Purchase insurance in the required amounts.
4. Submit either an original $5,000 surety bond, or a $5,000 security deposit.
5. Pay a $55 fee.

* * * * *

SHOULD I EXTEND MY REGISTRATION TO COVER COMMERCIAL AND INDUSTRIAL WORK AS WELL AS RESIDENTIAL WORK?

This is entirely up to you. In some cases, this extension will keep you from having to pay extra fees to some cities and counties when you work within their boundaries. However, it also means that claims can be filed against you through the Builders Board for commercial and industrial work as well as for residential work.

If you decide to extend your registration to commercial and industrial work, you can do so when you first register with the Builders Board or when you renew your registration by:

1. Informing your bonding company that you want to extend your registration and
2. Submitting a written request to the Builders Board asking that your registration be extended.

* * * * *

WHAT KIND OF BOND DO I NEED?

You must submit a $5,000 surety bond on a form prescribed by the Builders Board, which may be purchased from your insurance agent, through various trade associations, or directly from a bonding company.

You must submit the original bond; a copy of the bond will not be accepted. BE SURE THAT YOU SIGN THE BOND.

How your name appears on the bond is **extremely important.** If your business is an individual proprietorship, your bond must be in your personal name and any business name(s) you will be using. For example: John A. Austin; or John A. Austin dba J. A. Construction.

If your business is a partnership, your bond must be in the personal names of all partners and any business name(s) you will be using. For example: John A. Austin and Dean Meyer; or John A. Austin and Dean Meyer dba Hillside Const.

If your business is a corporation, your bond must be in the name of your corporation as it is registered with the Corporation Division and any business name(s) you will be using. For example: Hillside Construction, Inc.; or Hillside Construction, Inc. dba Gresham Floorcovering.

THE NAMES ON YOUR APPLICATION AND ON THE BOND MUST BE IDENTICAL. IF THEY ARE NOT IDENTICAL, YOUR APPLICATION WILL NOT BE ACCEPTED.

After you have been registered for one year, you may qualify for a lower bond amount if your gross business volume is less than $30,000 per year.

* * * * *

IS THERE AN ALTERNATIVE TO THE PURCHASE OF A BOND?

Yes. If you wish, you may deposit $5,000 cash or in federal government securities in a bank or other financial institution in Oregon, to be held for the Builders Board as security, should any claims be filed against you.

If necessary, the Builders Board will pay any unresolved claims out of this deposit.

Any interest earned on this deposit is yours, but the cash or securities must remain in the bank AT LEAST ONE YEAR FROM THE DATE YOU NOTIFY THE BOARD THAT YOU HAVE STOPPED WORKING AS A BUILDER. If claims have been filed against you, the deposit must be held until they have been resolved.

For this reason, we suggest that you use this alternative only if you are certain that you will not need the cash or securities for up to three years after your registration becomes inactive.

If you decide to use this alternative to the purchase of a bond, you can get the necessary forms from your bank or from the Builders Board.

* * * * *

WHAT KIND OF INSURANCE DO I NEED?

You must purchase insurance of the following types and amounts:

Property Damage	$25,000;
Personal Injury	$50,000 (including death to one person);
	$100,000 (including death to more than one person).

INSTRUCTIONS FOR COMPLETION OF THE APPLICATION FORM

1. Read the instructions in this packet.

2. Print or type all entries.

3. Check any of the numbered boxes that apply to you.

   —Check either box 4, 5, or 6. Do not check more than one.
   —Complete the application section on the back of the form.

4. Register your business name (if you are using a business name) or corporation with the Corporation Division BEFORE you submit your registration to the Builders Board.

5. Sign the application before a notary public.

6. Send your application for registration to the Builders Board accompanied with the following items:

   —The original, signed bond or deposit form

   —The $55 registration fee

   IF THESE ITEMS ARE NOT SENT TOGETHER AND COMPLETED CORRECTLY, THEY WILL ALL BE RETURNED TO YOU FOR PROPER COMPLETION.

7. Mail or bring your application, bond and $55 fee to:

   Builders Board
   403 Labor & Industries Building
   Salem, Oregon 97310-0180

NOTE: Approximately 20% of the applications submitted to the Builders Board must be returned as unacceptable to the applicant because of the following:

1) Failure to properly complete and sign the application and have it notarized, and/or

2) The bond is issued in an incorrect amount, name, effective date, and/or is unsigned by the applicant, or unsigned by a corporate officer.

These problems cause unnecessary delays in the issuance of registrations and result in extra work for everyone. We appreciate your assistance in solving these problems.

gistration # ______

ue ______

newal ______

pe ______

CR B D USE ONLY

STATE OF OREGON
DEPARTMENT OF COMMERCE
BUILDERS BOARD
403 LABOR AND INDUSTRIES BUILDING
SALEM, OREGON 97310-0180

082
$55.00

APPLICATION FOR REGISTRATION

REGISTERED CORPORATE NAME AND/OR BUSINESS NAMES, IF ANY, OTHERWISE BUILDER'S NAME			
MAILING ADDRESS		TELEPHONE NUMBER	
CITY	STATE	ZIP CODE	COUNTY
LOCATION ADDRESS (IF DIFFERENT FROM MAILING ADDRESS)			
CITY	STATE	ZIP CODE	COUNTY

☐ CHECK here if you wish to include your nonresidential work under your registration. This is a VOLUNTARY expansion of your registration.

☐ 1. If you are now or have previously been registered with the Builders Board, check this box and complete A and/or B below:

A. If you are **currently registered**, give your registration number: ______.
Do you wish to have any current registrations terminated and replaced with this registration: ☐ YES ☐ NO

B. If you have been registered in the past, give your previous registration number(s) and/or business name(s) used in previous registrations:

______

☐ 2. If you have not paid in full any final judgment on a claim adjudged against you as a builder by the Builders Board or a court, check this box and attach a separate sheet giving details.

☐ 3. If you plan to hire or trade help, check this box and complete Section D on back of this form.

TYPE OF OWNERSHIP

You must check one and complete the noted section on back of this form.

☐ 4. If your business is an **individual proprietorship**, check this box and complete Section A on the back of this form.

☐ 5. If your business is a **partnership**, check this box and complete Section B on the back of this form.

☐ 6. If your business is a **corporation**, check this box and complete Section C on the back of this form.

AFFIDAVIT

I HEREBY CERTIFY that effective this date and for as long as this registration is in effect, I have and will continue to have insurance of the type and in the amounts required by ORS 701.105. I understand that failure to carry this insurance may result in a $1,000 fine.

______ Name of Liability Insurance Company ______ Policy Number

I HEREBY CERTIFY that any corporation and/or assumed business name included in this application has been recorded with the Corporation Commissioner and approved for use by the applicant.

I HEREBY CERTIFY, under penalty of perjury, that to the best of my knowledge, all statements on both sides of this form are complete, true, and correct.

______ Signature

tate of ______

ounty of ______

igned or attested before me on ______, 19____, by ______.

______ Notary Public for Oregon

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SECTION A
Complete ONLY if you checked box 4.

Name of Owner		Birthdate	Social Security No.
Address			Telephone Number
City	State	Zip Code	County

SECTION B
Complete ONLY if you checked box 5.

Names of All Partners	Addresses	Phone Nos.	Birthdates
1.			
2.			
3.			
4.			
5.			
6.			

SECTION C
Complete ONLY if you checked box 6.

Names of Officers	Addresses	Titles
		President
		Vice Pres.
		Secretary
		Treasurer

☐ Check this box if you have applied for these account numbers.

SECTION D
Complete ONLY if you checked box 3.

Workers Comp. Account No.	Unemployment Insurance Account No.
State Withholding Account No.	Federal Withholding Account No.

HOW DO I RENEW MY REGISTRATION?

You must renew your registration every year. As a courtesy and reminder, the Builders Board will send you a renewal notice approximately two months before the date your registration expires.

You should know your renewal date and contact the Builders Board if you do not receive a renewal notice. **It is your responsibility to keep your registration active at all times if you are working as a builder.**

* * * * *

AFTER I REGISTER WITH THE BUILDERS BOARD, WILL I NEED ANY OTHER LICENSES TO DO BUSINESS?

Yes; if you are doing plumbing or electrical work, contact the Building Codes Division, Department of Commerce, 401 Labor & Industries Building, Salem, Oregon 97310. Electrical section telephone: 378-4046. Plumbing section telephone: 378-3169.

You should contact the city hall in any city in which you are working to see if you need a business license.

Additional information can be obtained from the State Permit Coordination Section at 373-1234.

* * * * *

AFTER I COMPLETE MY FIRST REGISTRATION, DO I HAVE TO DO ANYTHING TO REMAIN REGISTERED?

The main thing you have to do to remain registered is to keep your bond and insurance in effect.

However, the Board can also revoke, suspend, or refuse to renew your registration if:

1. You have not paid in full any final judgment on claims resulting from a decision of the Builders Board or a court.
2. You engage in conduct as a builder that is dishonest or fraudulent.
3. You fail to pay your material suppliers or subcontractors, causing a lien to be filed on a structure owned by a consumer.
4. You knowingly assist an unregistered person to act in violation of the Homebuilders Law.
5. You violate the Homebuilders Law or the Administrative Rules of the Builders Board.

* * * * *

IMPORTANT NOTICE

You must notify the Builders Board of any change of address as long as you are registered AND one year after you are no longer registered. We cannot inform you of any problems with your registration or of any claims which have been filed against you without a proper address.

It is also your responsibility to inform the Builders Board of any change in the ownership of your business (for example, a change from a partnership to a corporation or a change in the names of the partners). Any such change requires a new registration.

BUILDERS BOARD
DEPARTMENT OF COMMERCE
LABOR & INDUSTRIES BUILDING
SALEM, OREGON 97310-0180

STATE OF OREGON DEPARTMENT OF COMMERCE
BUILDERS BOARD

SURETY BOND

Surety Company's
Bond No. ____________

Builders Board
Registration No. ____________

____

as principal, and ____
a corporation qualified and authorized to do business in the State of Oregon, as surety, are held and firmly bound unto the State of Oregon for the use and benefit of the State of Oregon and of any other interested person in the sum of ______________________________ ($) lawful money of the United States of America for the use and benefit as provided in ORS 701.085, for which payment well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above-named principal has made application for a Certificate of Registration with the Department of Commerce, Builders Board, of the State of Oregon, or for renewal of a Certificate of Registration and is required by ORS 701.085 to furnish a bond in the penal sum of ______________ dollars, with good and sufficient surety, conditioned as herein set forth.

NOW THEREFORE, the conditions of the foregoing obligation are that if said principal with regard to all work done by the principal as a "Builder," as defined by ORS 701.005, shall pay all persons furnishing labor or materials, or renting or supplying equipment to the builder, pay all amounts that may be adjudged by the Builders Board against the principal by reason of negligent or improper work or breach of contract in performing any of said work, whether sought by the owner of the structure or another builder who contracted with the principal, and pay all amounts that may be adjudged by the Builders Board against the principal to discharge or repay funds expended to discharge a lien placed on an owner's property where the principal failed to pay the person claiming the lien, then this obligation shall be void; otherwise to remain in full force and effect.

This bond is for the exclusive purpose of payment of final orders of the Builders Board in accordance with ORS 701.085.

This bond shall be one continuing obligation, and the liability of the surety for the aggregate of any and all claims which may arise hereunder shall in no event exceed the amount of the penalty of this bond.

This bond shall become effective on the date the builder meets all requirements for registration or renewal and shall remain in effect for one year from that date or until depleted by claims paid under ORS 701.140, unless the surety sooner cancels the bond. This bond may be cancelled by the surety and the surety be relieved of further liability hereunder by giving 30 days' written notice to the principal and the Builders Board of the State of Oregon.

THIS BOND SHALL NOT BE VALID FOR PURPOSES OF REGISTRATION IN ACCORDANCE WITH ORS 701.085 UNLESS FILED WITH THE BUILDERS BOARD WITHIN 30 DAYS OF THE DATE SHOWN BELOW.

IN WITNESS WHEREOF, the Principal and Surety have hereto set their hands and seals this

______________ day of ______________, 19____.

Surety	*Principal*
Name ______________________	Business Name ______________________
By ______________ Title ________	By ______________ Title ________
Street address ______________________	
City __________ State ________ Zip ________	

814-070-2 (Rev. 8/83)

Assignment

- Complete job sheet.
- Complete self assessment.
- Complete post assessment.

Job Sheet

COMPLETE APPLICATION FORM

- Complete the application for registration with the Oregon Department of Commerce.

Self Assessment

Match terms and phrases.

____ 1. Surety bond

____ 2. Personal injury insurance

____ 3. Property damage insurance

____ 4. Registration fee

____ 5. Builders Board

____ 6. Homebuilders Law

____ 7. Oregon Lien Law

____ 8. Administrative Rule Chapter 812

____ 9. Revised statute

____ 10. Lien

A. Must have $25,000.

B. Costs $55

C. Located in Department of Commerce

D. Must have $5,000

E. Must have $50,000 including death to one person

F. Chapter 87 (ORS)

G. Govern actions of the Builders'Board

H. Chapter 701 of ORS

I. State laws

J. Claim against property for money owed

Self Assessment Answers

D 1.

E 2.

A 3.

B 4.

C 5.

H 6.

F 7.

G 8.

I 9.

J 10.

Post Assessment

1. Where would you apply for registration as a security alarm business?

2. How much surety bonding will be required?

3. How much personal injury insurance will be required?

4. How much property damage insurance will be required?

5. What will the registration cost?

6. What is the difference between an Oregon Revised Statute and an Oregon Administrative Rule?

7. Is the Oregon Homebuilders Law an ORS or an OAR?

8. Is the Oregon Lien Law an ORS or OAR?

9. Does the installer get licensed through the Builders' Board? Which other division of the Department of Commerce handle licensing?

10. How can registration be extended to commercial and industrial work?

Instructor Post Assessment Answers

1. Builder Board, Department of Commerce, 403 Labor and Industries Building, Salem, Oregon.

2. $5,000

3. $50,000 for one death, $100,000 for more than one death

4. $25,000

5. $55

6. The ORS statutes are state laws. Administrative rules reflect working policies based on interpretations of the statutes.

7. ORS

8. ORS

9. No. Building Codes Division

10. By informing bonding company of extension and submitting a written request for the extension.

Supplementary References

- Package is self-contained. Additional information is available from:

Builders' Board
403 Labor and Industries Building
Salem, Oregon 97310 - 0180
Telephone: (503) 378-4621

INSTRUCTIONAL LEARNING SYSTEMS

19.2

LICENSING

Goal:

The apprentice will be able to describe the requirements for a license to install low voltage alarm systems.

Performance Indicators:

1. Define requirement for license.
2. Identify type of license.
3. Identify the agency that issues license.

Study Guide

- Read the information sheets.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have your isntructor check the answers.

Vocabulary

- Building Codes Division
- Department of Commerce
- Limited energy electrical contractor
- Limited energy systems
- Limited journeyman/limited energy electrician
- National Electrical Code
- Oregon Administrative Rules (OAR)

Introduction

The National Electrical Code requires licenses for those that work with electricity. There are many types of electrical licenses. Each license is based on the nature of work to be performed by the journeyman.

An apprentice should understand these license requirements so that all requirements will be met by the time they reach journeyman level. A knowledge of the rules will help to prepare for the workplace and to avoid problems arising from being improperly licensed.

Information

OAR 814-22-110(3i) states that alarm systems installers must possess a valid license. The exact wording of the license requirements from Chapter 14, Division 22 of the Oregon Administrative Rules is shown below. All licenses are handled through the Building Codes Division of the Department of Commerce.

> "(i) Limited Journeyman/Limited Energy Electrician's License. Any person who installs, maintains, replaces, or repairs electrical wiring and electrical products conveying or operated by electrical energy not exceeding 100 VA in Class II and Class III installations under Article 725 of the 1981 edition of the National Electrical Code is required to have a valid Limited Journeyman/Limited Energy Electrician's License and shall be employed by a licensed electrical limited energy contractor. A Limited Journeyman Limited Energy Electrician shall sign all permits for limited energy electrical installations. Such licenses shall be limited to installations such as burglar alarms, fire protection signaling systems, signaling and control circuits, non-utility-owned communication systems, data processing controls, closed circuit television, MATV, CATV systems and similar systems except as permitted in paragraph (C)."

OAR 814-22-110 (1dC) states that no license is required to install some devices one and two family dwellings and in buildings less than 3 stories. The exact wording of that section of the OAR is:

> "(C) For the installation of limited energy systems not exceeding 100 VA in Class II and Class III as defined in Article 725 of the 1981 edition of the National Electric Code for intercommunication (audio) systems in one and two family dwellings, doorbells, sound and sound recording systems in residential occupancies, single station smoke or ionization systems, closed circuit TV systems in buildings three (3) stories or less in height except where interconnected with an installation system covered in section (3) of this rule, MATV and CATV systems in buildings of three (3) stories or less in height, and radio and television antenna systems."

An electrical contractor must have a limited energy electrical contractors license in order to employ limited journeymen. The fee for a contractor's license is $125.

Assignment

- Read the Oregon Administrative Rules (OAR), Section 22, that explains the electrical standards. Pay special attention to the rule on licensing. (814-22-110) (3i)
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have instructor check answers.

Job Sheet

- Complete application for license (See next page).
- Complete an application for an electrical contractor's license.

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State of Oregon
DEPARTMENT OF COMMERCE

Application for Journeyman Electrician's License

Name of Applicant ____________________ Age ________

Address ____________________ ____________________ ____________________
(Street number or R.F.D. and Box number) (City or Town) (Zip Code)

APPLICANT'S ELECTRICAL EXPERIENCE STATEMENT

Do you now hold a journeyman or apprentice electrician's license? ____________________

If so, give date of original issue ____________________ Issued by ____________________
(State or City)

Give names and addresses of employers and length of time employed. (This applies to electrical experience only, such as house wiring, industrial installations, industrial maintenance, etc.)

1. ____________________ From ________ to ________
(Name of Employer) (Length of Employment)
Address ____________________ ____________________
(Address of Employer) (City or Town)
Detail Experience ____________________

2. ____________________ From ________ to ________
Address ____________________
Detail Experience ____________________

3. ____________________ From ________ to ________
Address ____________________
Detail Experience ____________________

(If necessary, further information may be listed on back of this application)

CHECK THE TYPE OF JOURNEYMAN LICENSE DESIRED

☐ General Journeyman Electrician
☐ Limited Journeyman Mfg. Plant Electrician
☐ Limited Journeyman Industrial Electrician
☐ Limited Journeyman Railroad Electrician
☐ Limited Journeyman Sign Electrician
☐ Limited Journeyman Sign Service Electrician
☐ Limited Journeyman Elevator Electrician
☐ Limited Journeyman Elevator Service Electrician
☐ Limited Journeyman Stage Electrician
☐ Limited Journeyman Limited Energy Electrician

UNDER PENALTIES OF PERJURY, I DECLARE I HAVE EXAMINED THIS APPLICATION; AND TO THE BEST OF MY KNOWLEDGE AND BELIEF IT IS TRUE, CORRECT AND COMPLETE.

Date ____________________

Signature of Applicant

4. ______________________ From ________ to ________
(Name of employer) (Length of employment)
Address ______________________
(Address of employer) (City or town)
Detail Experience ______________________

5. ______________________ From ________ to ________
Address ______________________
Detail Experience ______________________

6. ______________________ From ________ to ________
Address ______________________
Detail Experience ______________________

7. ______________________ From ________ to ________
Address ______________________
Detail Experience ______________________

8. ______________________ From ________ to ________
Address ______________________
Detail Experience ______________________

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State of Oregon
DEPARTMENT OF COMMERCE

01-831-121

LIMITED ENERGY

Application for Electrical Contractor's License

The undersigned hereby makes application for a license to engage as an electrical contractor for the installation of wires, appliances or equipment, to convey or be operated by electric current, as defined and provided for by Chapter 479, Oregon Revised Statutes.

Firm Name

Address Phone

City State Zip County

☐ Corporation ☐ Individual ☐ Partnership

If firm is operating under an assumed business name, list the assumed business name and all parties having an interest therein. Assumed business names must be registered with the Corporation Commission.

Assumed Business Name

Parties having an interest:

Name of Manager

NAME OF LICENSED LIMITED JOURNEYMAN LIMITED ENERGY ELECTRICIANS:

By

Title

LICENSE FEE OF $125 MUST ACCOMPANY THIS APPLICATION

Separate license must be secured for each place of business.

Self Assessment

1. What type of license is required for installing alarm systems?

2. Who issues the license?

3. Where is the rule that requires a license to be found?

Self Assessment Answers

1. Limited Journeyman/Limited Energy Electrician

2. Building Codes Division, Oregon Department of Commerce

3. Oregon Administrative Rules

Post Assessment

1. Where would you file an application for license?

2. What kind of license would you file for?

3. What is the fee for a Limited Journeyman/Limited Energy license?

4. What is the fee for a limited energy electrical contractors license?

Instructor Post Assessment Answers

1. Building Code Division, Department of Commerce
2. Limited Journeyman/Limited Energy Electrician
3. $15
4. $125

Supplementary References

- Licensing: Building Codes Division
  401 Labor and Industries Building
  Salem, Oregon 97310
  Telephone: 378-4046

INSTRUCTIONAL LEARNING SYSTEMS

20.1

CENTRAL STATIONS

Goal:

The apprentice will be able to describe central stations and their operation.

Performance Indicators:

1. Describe central stations.
2. Describe types of central stations.
3. Describe how central stations operate.
4. Describe signal transmission systems.
5. Describe alarm system displays.

Study Guide

- Read the goal and performance indicators. This will show you what you are expected to learn from the package.
- Read the vocabulary list to see the new terms that will be found in the package.
- Study the material in the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and ask instructor to check answers.

Vocabulary

- Alternating current transmission system
- Annunciator/display panel
- Central station
- Commercial
- CRT displays
- Dedicated transmission lines
- Digital dialers
- Direct current transmission lines
- Event recorders
- Frequency Division multiplexing
- Interrogator
- Map displays
- McCulloh circuit
- Modems
- Multiplexing
- Numeric displays
- Proprietary
- Radio frequency transmission
- Resistive bridge circuit
- Signal transmission systems
- Tape dialers
- Time division multiplexing
- Time slots
- Transceivers
- Transponders
- Undedicated transmission line

Introduction

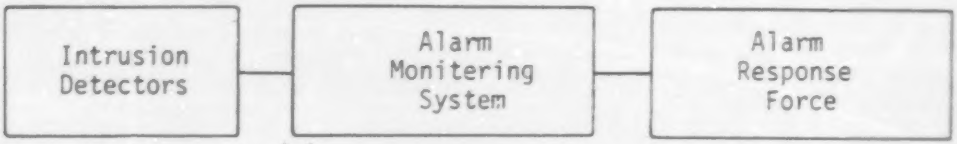
The central station is a key component of alarm systems. Signals from sensors are transmitted to the central station. The signals are shown on a signal display panel. The operator views the display panel and sets a response force into action.

There are many kinds of central station arrangements. The technical details cannot be presented in this package. This package will acquaint the apprentice installer with the several systems for transmission of signals and the display panels used in a central station.

Information

CENTRAL STATIONS

A central alarm station is a control center that receives signals from the protected areas. The central station is responsible for setting a response force in motion. A total alarm system is made up of the following:



The central station is the middleman that monitors the detectors and alarms the response force. Trained operators monitor the display panels around the clock. When the display panels show an emergency, the oeprator notifies the proper authorities.

A central station may be set up to monitor intrusion alarms, fire alarms, panic alarms and other sensing devices. For example, Honeywell provides environmental monitoring services to private firms. Through a central station, a monitor can control the climate in hundreds of buildings.

Types of Central Stations

Central stations can be commercial or proprietary. Commercial stations are located away from the protected areas. Proprietary stations are usually close to the area that is being monitored. Commercial stations are operated for a profit by private companies. Proprietary stations are used by a firm in the protection of their own facility or by a non-profit agency such as a city.

Components of a Monitoring System

A monitoring system is composed of:

- Signal transmission system that transmits signal from protected area to central station.
- Annunciating/display panel that tells operator that an alarm signal is being transmitted to the station.

Information

The signals are transmitted from the protected areas to the station by:

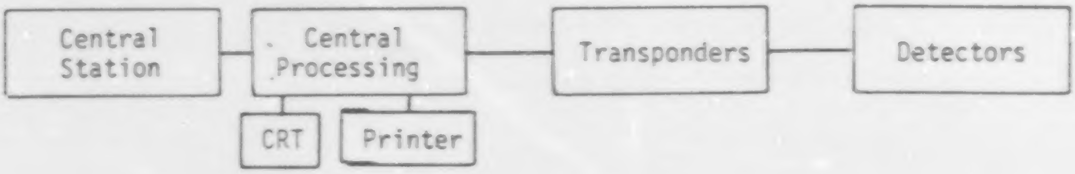
- Dedicated transmission lines which have the sole purpose of carrying alarm or other status signals.
- Undedicated communication channels include regular telephone lines and radio communication. The channels have many other functions beyond security.

The choice of dedicated or undedicated channels is dependent on the transmission device. Most DC transmission devices require dedicated lines. McCulloh circuits and multiplexed systems use a single dedicated line. Digital dialers use normal telephone service lines. Radio transmission is also used as an undedicated channel for moving signals into the central station.

Operation of a Central Station

The alarm signal enters the central station by either a dedicated or undedicated transmission line. The signal is displayed on the annunciator/display panel. The display panel might show as a map of the area. The map helps the monitor in giving directions to a response force. Many monitoring systems have event recorders that give printouts on status changes.

Computerized systems use CRT displays, indicator panels, map displays and line printers to display information. Many computerized monitoring systems give response instructions to the operator. The computer can be used to perform command functions for operating closed circuit cameras, environmental controls and doors. A computer managed system uses transponders to report from the protected areas.

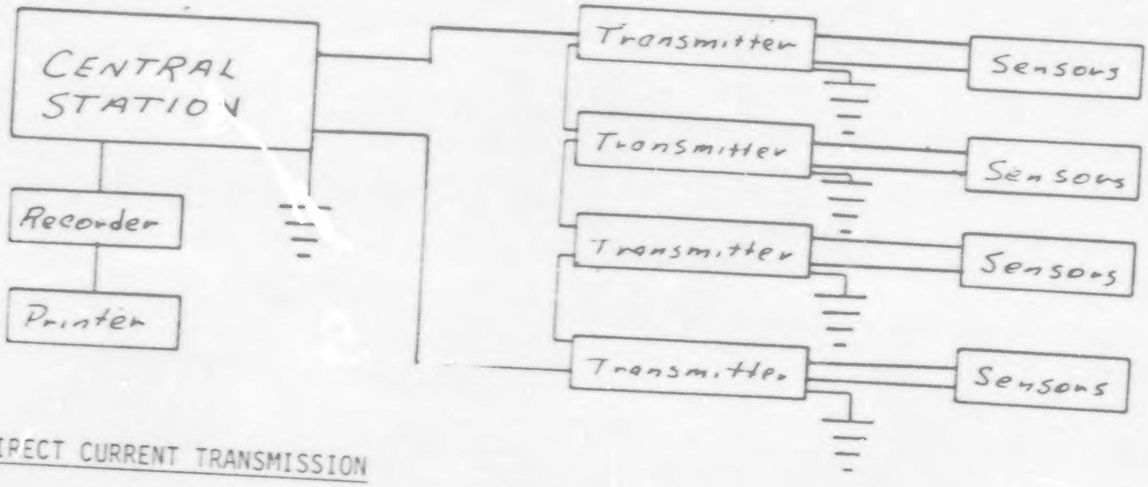


Information

SIGNAL TRANSMISSION SYSTEMS

McCULLOH CIRCUIT

The McCulloh Circuit works like the old telephone party line. One line is used to service many customers. Each customer has a code. This code is transmitted to the central station by a series of pulses. The pulses are transmitted as "grounds" and "breaks" in the circuit. A McCulloh circuit can service 20-30 customers on a single line. Line "clash" occurs when two customers codes are being transmitted at one time. The principle of the McCulloh circuit is shown by this block diagram:


CENTRAL STATION
Recorder
Printer
Transmitter
Transmitter
Transmitter
Transmitter
Sensors
Sensors
Sensors
Sensors

DIRECT CURRENT TRANSMISSION

Direct current transmission requires two dedicated wires from the central station to each protected area.. The old model DC lines were often disabled by cutting the line. A new version uses a balanced current to provide line supervision. By using a resistive bridge circuit in a monitor module, the cutting of lines can be detected. Such tampering will cause a change in the line supervision current.

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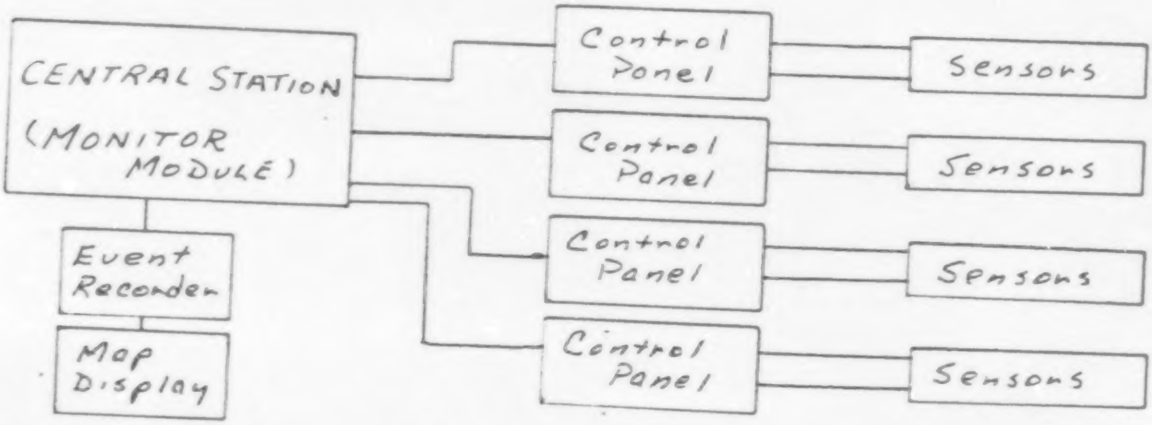
Information

A block diagram of a DC transmission system shows:


CENTRAL STATION
(MONITOR MODULE)
Event Recorder
Map Display
Control Panel
Control Panel
Control Panel
Control Panel
Sensors
Sensors
Sensors
Sensors

ALTERNATING CURRENT TRANSMISSION

AC signals can be transmitted over voice grade telephone lines. The system requires an AC balanced bridge circuit in the monitor module. These systems do not require dedicated lines which is a major advantage to central stations.

MULTIPLEX TRANSMISSION SYSTEM

A single communication channel can be used to transmit signals from many protected areas. The channel can be telephone lines, coaxial cable, microwave, radio or twisted wire cable. Voice grade telephone lines are the most popular at the present time. Rate increases for telephone lines may change the method of transmission in the future. Multiplexing uses two basic techniques:

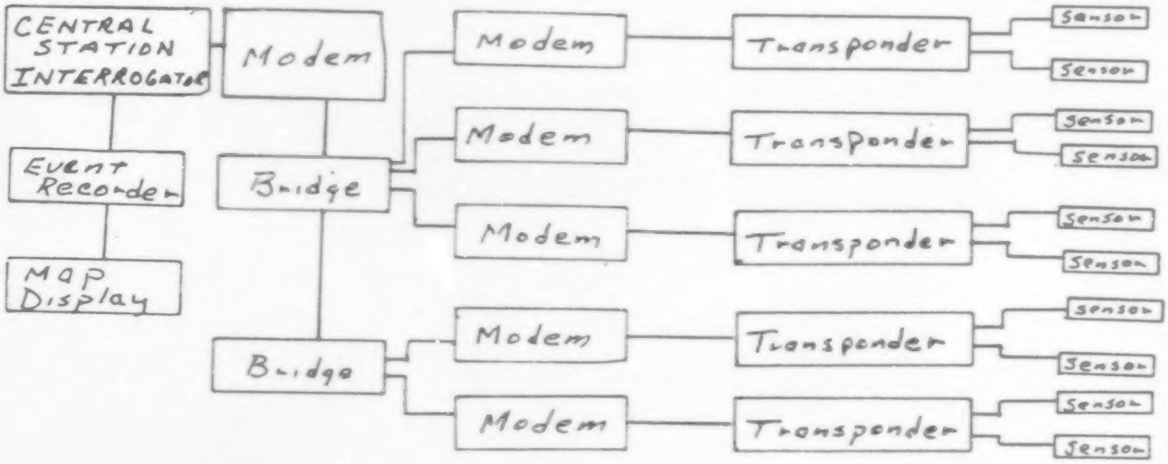
- Frequency division multiplexing (FDM)
- Time division multiplexing (TDM)

FDM involves breaking the channel into a number of sub-channels with separate frequencies. Each protected area is assigned a dedicated sub-channel frequency. This assures that each protected area has a channel of communication with the central station at all times.

Information

TDM divides time into sub-intervals called time slots. Each protected area communicates its status during its assigned time slot. TDM is the most popular of the two multiplexing techniques. TDM works well with computerized systems.

One of the common multiplex systems is the interrogate/response system. It operates on voice grade telephone lines. The interrogator sends out an address signal to the protected area. A transponder at that address will transmit a status report back to the central station. An interrogator is a combined receiver and transmitter. The transponder also acts as a receiver and transmitter. The transponder reports the status of the sensors back to the central station. Modems are part of the system. The modem converts binary logic into AC tones. A block diagram of an interrogate/response multiplex system shows the relationship of the parts of the system.


CENTRAL STATION INTERROGATOR
Modem
Event Recorder
Map Display
Bridge
Bridge
Modem
Modem
Modem
Modem
Modem
Transponder
Transponder
Transponder
Transponder
Transponder
Sensor
Sensor
Sensor
Sensor
Sensor
Sensor
Sensor
Sensor
Sensor
Sensor

The bridging of multiplex circuits can be a problem. Telephone companies do not provide this as a normal service. The installer must seek assistance of the companies that manufacture multiplex systems.

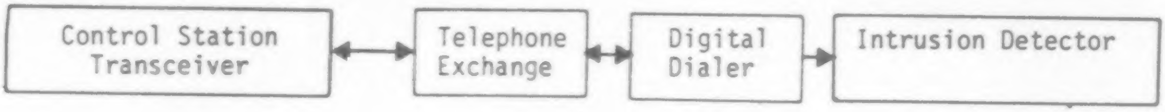
Digital Dialers

Digital dialers communicate messages in digital codes. These dialers differ from tape dialers that transmit recorded voice messages. The digital messages are transmitted over voice grade telephone lines to the central station. The message is received by a transceiver at the central station. The transceiver interprets

Information

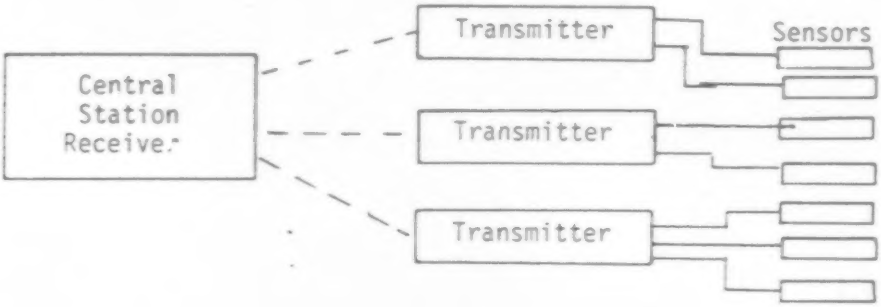
the message and displays it to the station operator.

Digital transceiver can handle the message from hundreds of digital dialers. The messages may travel through several telephone exchanges in getting between transceiver and dialer. Two-way communication exists between the dialer and transceiver. A block diagram of a digital dialer system is shown:


Control Station Transceiver
Telephone Exchange
Digital Dialer
Intrusion Detector

RF TRANSMISSION SYSTEMS

Radio frequency transmission systems are used to monitor protected areas where telephone lines do not exist. Transmitters and receivers must be placed in line-of-sight because of the frequency requirements of the FCC. This means that the antennas must be in view of each other. A block diagram shows the use of RF transmission for central station monitoring:


Central Station Receiver
Transmitter
Transmitter
Transmitter
Sensors

Electromagnetic interference can be a major problem in RF transmission.

Information

ALARM SIGNAL DISPLAYS

ANNUNCIATOR PANELS

Indicator lights are used to annunciate alarms to the station operation. Sets of lights are used to annunciate a protected area. Single lights are used to annunciate individual sensors.

NUMERIC DISPLAYS

Numeric displays annunciate alarm information by numbers. Each protected area has an identification number which allows the operator to know which area is sending the signal. Indicator lights are used with numeric displays.

MAP DISPLAYS

Map displays identify locations of the protected areas and sensors that are reporting. These displays help the monitor in giving directions to the response force.

Assignment

- For further understanding of alarm station monitoring systems, the apprentice should read pages 193-243 in the supplementary reference.
- Complete the job sheet.
- Complete self assessment and check answers.
- Complete post assessment and ask instructor to check answers.

Job Sheet

VISIT A CENTRAL STATION

- Arrange for a field trip/visit to a central station. Inform the station operator that the visit is for learning purposes.
- Analyze the way that the station operates.
  - What signal transmission system is used?
  - How are the signals annunciated?
  - How is the response force notified of alarms.
- Make a block diagram that shows how a signal flows from the sensors through the central station to the response force.

Self Assessment

1. Describe a central station.

2. List two important responsibilities of a central station operator.

3. List two types of central stations.

4. What are the two major components of a monitoring system?

5. Describe a dedicated line.

6. Alarm signals are shown on the ______________ panel in the central station.

7. List four types of signal transmission systems.

8. What is meant by FDM and TDM?

9. How do tape and digital dialers differ?

10. List three types of alarm signal displays.

Self Assessment Answers

1. A control center for many protected areas.
2. Monitor signals from protected areas.
   Set response force in action.
3. Commercial and proprietary.
4. Signal transmission device and annunciator/display panel.
5. One with the sole purpose of carrying alarm signals.
6. Annunciator/display
7. McCulloh circuit, direct current transmission, AC transmission, multiplex, digital dialers, RF transmission.
8. FDM -- Frequency Division Multiplexing
   TDM -- Time Division Multiplexing
9. Tape uses audio voice transmission.
   Digital dialers transmit in digital logic.
10. Annunciator panels, numeric displays, map displays.

Post Assessment

1. A control center for monitoring alarm devices is called a ________________.

2. A signal transmission system that operates like the old telephone party line is the ________________.

3. A multiplexing technique that breaks a time cycle into sub-intervals of time is called __________ ______________ ______________.

4. A multiplexing technique that breaks frequency down into subfrequencies is called ____________ ______________ ________________.

5. A dialer that uses audio voice is called a ______________dialer.

6. A dialer that uses binary numbers in transmission is called a ___________ dialer.

7. ____________________ interference can be a problem in RF transmission systems.

8. Which transmission system uses two-way communication between the central station and the protected area?

9. Which transmission system requires bridging of the telephone circuits?

10. A device that records alarms and status changes is called an _________ ________________.

Instructor Post Assessment Answers

1. Central station
2. McCulloh Circuit
3. Time Division Multiplexing (TDM)
4. Frequency Division Multiplexing (FDM)
5. Tape
6. Digital
7. Electromagnetic
8. Digital dialers
9. Multiplexing
10. Event recorder

Supplementary References

Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

20.2

FIRE DEPARTMENT MONITORING

Goal:

The apprentice will be able to describe fire department monitoring.

Performance Indicators:

1. Describe transmission of fire alarms.
2. Describe annunciation of fire alarms.
3. Describe response time factor in fire alarms.

Study Guide

- Read the goal and performacne indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Ademco dialer
- Annunciation
- Modularm system
- Paramedic team
- Proprietary stations
- Sescoa dialer

Introduction

Fire departments are responsible for the safety of the citizens within their area and for saving property from fire damage. In order to save property and lives from fire, the fireman must reach the scene as early as possible. A quick response is critical to control of a fire.

The detection system must alarm while the fire is small. That alarm signal must reach the fire department immediately. A response force must move firefighting equipment to the scene without any loss of time.

The fire station must be monitored around the clock and decisions must be made quickly upon receipt of an alarm. The decision-making and alertness of the station monitor will affect the reponse time of the department.

Information

Fire departments in Oregon usually monitor alarm systems for public and commercial interests within their city. Each fire dcepartment may have one or more systems of transmission into their stations. For example, Albany uses 3 different systems of transmission. Due to local budget constraints, fire departments may not have state of the art equipment for monitoring alarms.

Emergency and medical services are often linked with the fire departments paramedic teams. Some systems monitor both fire and emergency alarms.

Transmission Systems

The trend is toward multiplexing systems that can handle both fire and emergency alarms. Digital dialing systems are also used in transmission. The Ademco and Sescoa dialers have received laboratory approval as fire alarm transmission systems. Tape dialers are found in many local fire stations.

Monitoring

Monitoring of alarms for commercial and public buildings is usually the responsibility of a local fire department. Central stations operated by telephone answering services and private companies monitor alarm systems for homeowners. The response time on fire alarms is the critical factor in a monitoring system. In small towns, the monitoring is performed by the fire dispatcher so that a response can be made without a loss in time. Whether the alarm is transmitted by tape dialers, digital dialers or direct wired loop, the response must be immediate.

Annunciation of Alarms

Alarms are annunciated through both visual and audible means. Lights, buzzers and sirens are used to alert the response force of the alarm. Map displays may be used to show specific locations of the alarm.

Proprietary Stations

Many residential areas have their own monitoring station and some fire fighting capability. In proprietary stations, burglar, fire and panic alarms are monitored in the same station. Such developments usually have a security patrol that serves as a response force. These stations have computerized data on medical needs, family situations and lists of valuables to be protected from fire and theft. The monitor has specific data on which to make a response. For instance, all heart patients are entered into the data bank. An emergency

information

alarm at that dwelling will bring a CPR trained person as part of the response force.

An example of a monitoring unit for fire alarms is shown below. This unit is known as a Modularm system. A modularm unit is connected to the protected area by a leased phone line. This unit can be used by fire, police and telephone answering service monitors.

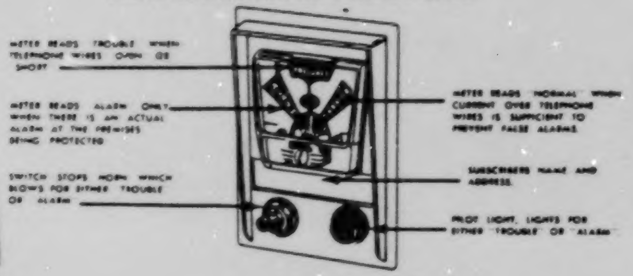
130

TWO DIFFERENT MODULARM SYSTEMS

THE MODULARM NO. 130 is a compact, e-x-p-a-n-d-a-b-l-e system for automatically monitoring alarm circuits at police headquarters, fire departments, central offices or telephone answering services. The monitoring headquarters is connected to the premises being protected by means of a leased telephone line. One Modularm plug-in unit and one leased telephone line is required for each subscriber being protected. The Modularm No. 130 features a circuit that instantly distinguishes between an actual alarm and an open or shorted telephone line. A meter constantly shows when the supervisory current flowing through the telephone line is "NORMAL." There can be no errors! All guesswork has been eliminated! One glance at the meters in the Modularm shows the condition of all the telephone circuits. An alarm from any subscriber starts the horn unit blowing in the console cabinet at headquarters, alerting the person in charge. At the same time, a pilot light in a Modularm 130 lights and identifies the subscriber. Its meter reads "ALARM." The horn continues to blow at headquarters, even if the intruder quickly opens and closes the door. To stop the horn, a button on the Modularm unit is pressed. The horn stops blowing, but the pilot light stays on until the subscriber's alarm has been shut off by an authorized person on the premises. The Modularm now resets itself automatically and is ready for another alarm.

THE MODULARM NO. 133 is similar in operation to Modularm No. 130 except that it does not distinguish between an actual alarm and telephone line trouble. It is primarily recommended for maintaining internal plant security when telephone lines are not needed. Modularm No. 133 automatically keeps a security watch on any device electrically connected to it. For example, warning would be given if any unathorized door or window were opened, or a freezer or refrigerator temperature were to rise to dangerous levels, or fire were to break out in protected areas, or if water pressure would fall to a dangerous level, or if any other electrical device failed, malfunctioned or did not operate as intended.

HOW MODULARM FUNCTIONS


METER READS TROUBLE WHEN TELEPHONE WIRES OPEN OR SHORT
METER READS ALARM ONLY WHEN THERE IS AN ACTUAL ALARM AT THE PREMISES BEING PROTECTED
SWITCH STOPS HORN WHICH BLOWS FOR EITHER TROUBLE OR ALARM
METER READS NORMAL WHEN CURRENT OVER TELEPHONE WIRES IS SUFFICIENT TO PREVENT FALSE ALARMS
SUBSCRIBERS NAME AND ADDRESS
PILOT LIGHT, LIGHTS FOR EITHER "TROUBLE" OR "ALARM"

HOW TO ORDER

No. 132	Console Cabinet, holds up to 5 plug-in Modularm Units. 16¼" W x 5¼" D x 4" H, stackable.
No. 131	Signaling Horn, plug-in module, one required.
No. 83	Energy Pack.
No. 130	Modularm, plug-in module, one per subscriber, identifies alarm condition and telephone line trouble.
No. 133	Modularm, plug-in module, one per subscriber or device being monitored. Identifies alarm condition only. Ideal for in plant security.

BEST COPY AVAILABLE

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check answers.

Job Sheet

VISIT LOCAL FIRE DEPARTMENT

- Visit local fire department.
- Observe system for transmission of signals, monitoring and responding to alarms.
- Ask questions to clarify the components of the system and how they function.

Self Assessment

1. List three types of transmission systems that might be found in Oregon fire departments?

2. Who is served by fire department monitoring stations?

3. List two basic types of annunciation common to fire alarms?

4. What is the purpose of a map display?

5. List one brand of digital dialer that has been laboratory tested approved for use in fire departments.

Self Assessment Answers

1. Tape dialers, digital dialers, multiplex systems, direct wired loops.
2. Commercial and public interests.
3. Audible, visual
4. Shows exact location of fire alarm and saves time in making a response.
5. Sescoa, Ademco

Post Assessment

1. A siren is an example of ________________________ annunciation.

2. Strobe lights are examples of _________________________ annunciation.

3. A panel that shows the exact locatin of an alarm is a ___________________ ______________________.

4. ________________________ and Sescoa dialers have been laboratory tested and approved for transmission in fire departments.

5. List three common types of equipment for transmission of fire alarm signals?

Instructor Post Assessment Answers

1. Audible
2. Visual
3. Map display
4. Ademco
5. Tape dialers, digital dialers, multiplex systems, direct wired loops

Supplementary References

- Local Fire Departments

INSTRUCTIONAL LEARNING SYSTEMS

20.3

POLICE DEPARTMENT MONITORING

Goal:

The apprentice will be able to describe police department monitoring of alarm signals.

Performance Indicators:

1. Describe clients served.
2. Identify transmission systems used.
3. Describe problem of false alarms.
4. Describe annunciation of alarms.
5. Describe how response force is assigned.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Annunciator
- Digital dialers
- Event recorder
- Map display
- McColloh circuit
- Multiplex system

Introduction

Police or other law enforcement agents are needed to apprehend burglars after the alarm is sounded. The police officers have the training for walking among dangerous types. The average citizen may get injured in attempting to deal with a burglar.

Many alarm systems are directly linked with the local police station. Those systems are normally businesses and public institutions within the city. In most cases, the police departments do not serve individual home security systems. The incidence of false alarming has discouraged police from moving deeper into the security alarm field. Most homeowners are serviced by a telephone answering service or other central station. The central station screens the alarms and contact the police on those cases deemed worthy of investigation.

Information

Police Department monitoring is usually restricted to commercial and public buildings. A business must file a request with the Chief of Police in order to have the Police Department monitor their premises. Banks, schools and other types of businesses may request this service.

The signals are transmitted to a police station through McColloh transmitters, multiplex systems or digital dialers. The type of transmission depends on the size of the town and local budgets. Most systems have a tape that records the exact time and date that the alarm was triggered. Such a device is called an event recorder.

A member of the local police force monitors the system on a 24 hour basis. When an alarm is received, the police dispatcher radios a patrol car to investigate the alarm. The patrol car nearest to the alarm site will respond to the request.

False alarms of burglar alarm systems have been a headache for police. After a series of false alarms, the response time will become longer because the police expects another false alarm. This creates problems between the detection systems and the response force. It is important for installers to reduce false alarms to minimum levels. Only then can the system and the response force work as a team in apprehending intruders.

Burglar alarm systems are annunciated by bells, buzzers and lights in the police station. Large departments may have map displays that pinpoint the location of the alarm. This saves time in dispatching a police car to the scene.

A list of three names is maintained for each business being protected. Those names are called immediately upon alarm.

Assignment

- Read pagews 229-236 in supplementary reference.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and ask the instructor to check answers.

Job Sheet

VISIT A LOCAL POLICE STATION

- Ask them permission to observe the monitoring system.
- Which transmission systems are used?
- What types of audible annunciators are used?
- What types of visual annunciators are used?
- How is the response force alerted?

Self Assessment

1. Who are the clients or customers of police station monitoring systems?

2. What is the biggest problem in police department monitoring of burglar alarms?

3. How is the alarm communicated to the reponse force?

4. How are alarms annunciated in the police station?

5. List three types of signal transmission from the protected area to the police station.

Self Assessment Answers

1. Commercial firms, public institutions

2. False alarms

3. Radio communications

4. Bells, buzzers and lights

5. McColloh transmitter, multiplex systems, digital dialers

Post Assessment

1. Who normally responds to a burglar alarm after it is monitored at the police station?

2. Who does the monitoring in most small police stations?

3. List 3 common transmission systems used in police stations.

4. What are map displays used for?

5. What is the number one headache encountered by police in monitoring burglar alarm systems?

Instructor Post Assessment Answers

1. Patrol car nearest the alarm site.

2. Police dispatcher.

3. McColloh transmitter, multiplex system, digital dialers.

4. To visually display location of the alarm and save time in assigning a response force.

5. False alarms.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

20.4

TELEPHONE ANSWERING SERVICE MONITORING

Goal:

The apprentice will be able to describe telephone answering service monitoring of security alarm signals.

Performance Indicators:

1. Describe typical answering service monitoring station.
2. Describe economic advangates of digital dialers.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Audible annunciation
- CRT displays
- Digital dialer
- Filedex system
- Visual annunciation

Introduction

The telephone answering services are rapidly becoming a major part of the security alarm field. With digital dialers, voice grade telephone lines can be used to transmit alarm signals to a central station. The cost of direct wired, metallic lines to each protected site is not needed with digital dialers. The central station can be far removed from the protected site. This places the telephone answering service at an economic advantage as monitors of security alarms.

An increase in residential security systems has expanded the need for monitoring services. Traditional monitoring agencies such as fire and police departments restrict their services to local business places. Answering services have picked up much of this expansion into residential security systems.

Information

Telephone answering companies are expanding their services as monitors of security alarm systems. Answering services have 24 hour staff on board so it makes them suitable as a monitoring station. In many cases, the police and fire departments only serve the public and commercial buildings within a city. Homeowners can be served by the answering service through existing telephone lines. Their customers include both homeowners and businesses.

A typical telephone answering service monitoring station is described below. The answering service accepts clients that wish to have their alarm systems monitored. The alarm systems include fire, burglar, and panic alarms. Each customer has a code number. A digital dialer communicates alarm status by transmitting the customers code number. The alarm is annunciated by both audible and visual methods. Also, an event recorder prints the time and date of the alarm. The monitoring staff reads the customer number and a number that represents the type of alarm. A file of customers and persons to be contacted is readily accessible through a filedex system. Calls are made immediately to the response force and the contact persons listed on the filedex cards. If the codes show the alarm to be a fire alarm, the local fire department is alerted. Burglar alarms are referred to the appropriate police agency.

Many telephone answering services have become central monitoring stations. They may still provide answering services but their major function is to monitor security alarm systems.

CRT displays can be attached to digital dialing equipment for providing additional visual annunciation, map displays and numeric displays. Most systems have an event recorder that establishes a record of alarms.

Digital dialers have opened up opportunities for the telephone answering services. Voice grade telephone lines can be used for transmitting digital signals to a distant location. The high costs of metallic lines have been eliminated by the digital dialers, making it economical for the answering services to become involved in monitoring.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Job Sheet

VISIT A TELEPHONE ANSWERING SERVICE CENTRAL STATION

- Ask permission to visit a telephone answering service that monitors alarm systems.
- Which transmission system is used?
- How are alarm signals annunciated?
- What are the procedures for notification of response forces?

Self Assessment

1. What types of alarm systems are commonly monitored by telephone answering services?

2. Who are the customers of telephone answering service monitors?

3. Which transmission system is commonly used in a telephone answering service monitoring station?

4. Which two code numbers are transmitted to the monitor?

5. How are response forces alerted?

Self Assessment Answers

1. Fire, burglar, panic

2. Homeowners and businesses

3. Digital dialers

4. Customer code number and type of alarm

5. Appropriate response agencies are called according to the type of alarm code.

Post Assessment

1. What type of transmission line is needed for digital dialers?

2. Can CRT's be used with digital dialers?

3. Which two groups are contacted when the answering service receives an alarm signal from a customer?

4. Who is served by an answering service monitoring station?

5. What types of alarm systems are commonly serviced by telephone answering stations?

Instructor Post Assessment Answers

1. Voice grade telephone lines

2. Yes

3. List of contact persons given by customer. Appropriate agency for response, i.e. Fire Department, Police Department

4. Homeowners and business places

5. Fire, burglar, panic

Supplementary References

- Local telephone answering service that operates as a central station.

INSTRUCTIONAL LEARNING SYSTEMS

21.1

FIRE/POLICE/EMERGENCY RESPONSES

Goal:

The apprentice will be able to describe how fire, police, emergency and medical teams respond to alarms.

Performance Indicators:

1. Describe fire alarm responses.
2. Describe burglar alarm responses.
3. Describe emergency medical response.
4. Describe annunciation of response force.
5. Describe radio transmissions in response team actions.
6. Describe proprietary response forces.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Audible annunciation
- CPR (Cardio-Pulmonary Resuscitation)
- Proprietary stations
- Response force
- Visual annunciation

Introduction

Security alarm systems are only as good as the response force that follows up on the alarms. People that are planning an alarm system should analyze the response force that will be utilized. A quick response is needed in all types of security systems.

The efficiency of the response team will depend on its distance from the protected site; response rate of the team; and the level of training of the response force. Installers of security alarm systems must consider the adequacy of the available response force in the design of a system. If a response force cannot provide a quick response, then the system must be designed to scare off the burglar or extinguish a fire. This means the addition of more sprinklers, louder annunciation and floodlights.

Information

The response force must act immediately on fire, burglar and emergency medical responses. A monitoring station operator must make quick decisions on the nature of the alarm and transmit requests to the response force. In case of fire alarms, the fire department is the response force. The fire department may also handle emergency medical alarms by dispatching paramedics to the scene. Burglar alarms are responded to by police or security guards. Each situation will be unique in its response force. All will be for making a quick response to alarms.

Most alarms use some type of audible annunciation. Sirens are used on fire trucks and police cars. Strobe lights provide visual annunciation of fires and police emergencies. Bells, buzzers and horns are part of some annuncation systems. Audible and visual annunciation is important for vehicles of a response force. It clears traffic and shortens the response time. The bells and buzzers at the station help to activate a response team and get them moving toward the alarm site. Volunteer firemen make up many fire teams in small towns. The fire buzzers or siren notifies them that they are needed at the fire hall.

Radio communications is important in responding to alarms. Police cars may be patrolling a neighborhood nearby the alarm site. The police dispatcher can assign the car nearest to the scene. Likewise, the radio promotes cooperation between various protective agencies. For example, the state police and city police may share in responses to alarms, depending on the agency that is closest to the scene. Radio also allows fire, ambulance and emergency vehicles to coordinate their efforts in handling emergencies. For example, a paramedic unit will call for an ambulance back-up in case the patient will need to be transported to a hospital.

In some proprietory stations, security guards may act as a response force for all types of alarms. In those cases, the security force has been trained in basic firefighting and emergency medical responses as well as methods of handling intruders. The response team must be cross-trained to handle this wide array of tasks. For example, such a security force would need first aid and CPR training. In proprietory stations, medical information has been computerized and medical conditions of the clients are known in advance by the reponse team. The security force also carry fire extinguishing equipment to catch fires while still small. The on-site security patrol can be an effective response force because they are near to the alarm site. Fires are caught in the early stages. Burglars can be caught at the site of the crime. In all cases, such a response force will utilize local fire and police departments as back-up. At least, these on-site security guards can sort out the false alarms for the police and fire departments.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and ask instructor to check answers.

Job Sheet

VISIT A FIRE DEPARTMENT

- Arrange with the Fire Chief to visit the fire station.
- How is response team alerted?
  - Type of annunciation
  - Quickness of response
- Does the department have a paramedic unit?
  - How do they respond to emergencies?
  - Are they closely linked with fire response team?
- What is the rate of false alarms?

Self Assessment

1. How can the efficiency of a reponse team be predicted for a given location?

2. Why do police and fire vehicles use strobe lights?

3. Why do police and fire annunciation include bells, sirens and buzzers?

4. Why is radio communications important in a response to security alarms?

5. What is the advantage of on-site security guards as a response force?

Self Assessment Answers

1. Distance from alarm site.
   Rate of response.
   Level of training of response force.

2. Help clear the road so that the vehicle can reach the alarm site in the shortest possible time.

3. Alert the response force. Sirens also help clear traffic from path of vehicle.

4. Coordination of response team efforts. Helps get response force to site quicker.

5. Quicker response because of their familiarity with premises. They do not have to travel.

Post Assessment

1. Why should security guards in proprietary stations be trained to respond to medical emergencies?

2. What is the best type of response to security alarm signals?

3. List two basic types of annunciation.

4. What type of communication system is used to coordinate response force actions?

5. Why are fire station sirens sounded so loudly?

Instructor Post Assessment Answers

1. Because they can respond to a medical emergency much quicker than a paramedic team. They are already on-site where the emergency is taking place.

2. Quick responses are the best ones.

3. Audible, visual

4. Radio

5. To alert the response force that quick action is necessary.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems. Pages 30-35. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

22.1

CARD ACCESS CONTROL

Goal:

The apprentice will be able to describe card access control and its application.

Performance Indicators:

1. Describe types of coded cardkeys.
2. Describe applications of coded cardkeys.

Study Guide

- Read the goal and performance indicators for this package. Find out what is to be learned from package.
- Read the vocabulary list. Get acquainted with the trade terms that will be used in this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Bar code
- Coded cardkey system
- Magnetic stripe
- Multi-period models

Introduction

All access control equipment can be classified as follows:

- Live guards
- Turnstiles
- Mechanical locks
- Coded cardkey systems
- Voice identification
- Remote control systems

This package explains the types and applications of coded keycards in access control systems.

Information

Coded cardkey systems are used to operate parking gates, security gates, turnstiles, electric strikes and other accesses to secure areas. Systems may be simple one card systems or multi-period models. The multi-period models change lock codes from time to time to invalidate old cards. Several types of codes are used on the cardkey.

- Bar code
- Magnetic stripe
- Handprints
- Fingerprints
- Photographs

Coded cardkeys are used in many types of applications. Basically, cardkeys are used for the purposes of:

- Entrance control
- Exit control
- Visitor control
- Package inspection
- Control of numbers in a facility at one time

Three common methods are used for encoding the cardkey. These are magnetc, capacitance and optical. All codes are read by electronic card reading system.

Bar Code

The bar code is used in cash registers at grocery stores for checking prices. The grocery clerk passes an item over a reader and the price is electronically recorded from the bar code. The bar code can be used on access control cards. An electronic scanner reads the identification numbers on the cardkey. If those numbers are on

Information

the list of authorized personnel, the access will be opened. Unauthorized cards will not be accepted and the gate will not open.

Magnetic Stripes

Cards have a stripe of magnetic material in a fixed position on the keycard. Information has been magnetically encoded on the magnetic stripe. The card is fed into an access control box. Magnetic force between the card and reader will trigger a switch that opens the access. Cards without a magnetic stripe would not be accepted and the gate would remain closed. VISA cards use a magnetic stripe which enables a person to get cash from a teller machine at night.

Handprint and Fingerprints

Handprints and fingerprints are used in cardkey codes. This system is used where strick security is needed. The person has a handprint or fingerprint on their I.D. card. This fingerprint must match a print in the master file of persons authorized for entry. Computerized systems will search their memory and match up fingerprints-

Photographs

Photographs are used on regular I.D. cards. The card is inserted into the access control unit. A central console scans its memory for the matching I.D. card. Any I.D. badge can be rendered totally functional or totally useless in three seconds. Another system employs "instant replay" video that allows the operator to compare a previous photograph with the one on the I.D. card.

Computerized Cardkey Systems

Many complex systems have been developed in the past few years. Some of these involve central consoles, memory, storage, printers, entry keyboards and many other features. These systems can assign levels of authorization, monitor the operator and a dozen other things.

Remote Control Systems

There are several systems that use closed circuit television to control entry/exit by remote control. A person walks into a booth and enters their I.D. card into an access control slot. A CCTV camera sends video pictures of the I.D. card and the individual to a remote guard station. The CCTV display is plit to show the I.D.

Information

photograph and the actual person side by side. The guard makes the identification and allows or disallows access.

Applications

Cardkeys are used in everything from cashing checks to the security of defense plants. The higher levels of security requires more complex systems. Many systems use keyed locks, guards and keycard systems. Others may use only one method of access control. Industrial plants are heavy users of keycards. Computer facilities have need of controlling unauthorized personnel. Any place that restricts the entry and exit of people is likely to have a keycard system. Security guard time for checking identification is greatly reduced with keycard control. This results in a savings because fewer live guards are required to secure the building.

Assignment

- Complete the job sheet.
- Complete the self assessment.
- Complete the post assessment and check answers.

Job Sheet

EXAMINE A VISA CARD

- Look at the reverse side of a VISA card. Note the brown stripe on the reverse side.
- Is this a magnetic stripe?
- What types of electronic information is coded on the brown stripe?
- How does a teller machine know that it is safe to give out money on this card?
- Visit with a bank employee about the cardkey features of your VISA card?

INSTRUCTIONAL LEARNING SYSTEMS

Self Assessment

1. List three methods used for encoding cardkeys.

2. Grocery stores use a ___________ code to mark prices on items.

3. List a common example of the use of magnetic stripe.

4. Remote control systems usually involve __________ ________ television.

5. What is the advantage of a keycard system over live guards?

Self Assessment Answers

1. Magnetic, capacitance, optical.

2. Bar

3. VISA card and other bank cards.

4. Closed circuit

5. Cost of personnel is reduced.

Post Assessment

1. List two purposes for cardkey control.

2. List four codes that can be used on cardkey.

3. List three methods for encoding the cardkeys.

4. Closed circuit television is often used in __________ control systems of card access.

5. Why are businesses moving from live guard systems to card access control systems?

Instructor Post Assessment Answers

1. Entrance control, exit control, visitor control, package inspection, control of numbers in a facility at one time.
2. Bar code, magnetic code, fingerprints, photographs, handprints.
3. Magnetic, capacitance, optical
4. Remote
5. Saves money. Card access reduces number of guards needed.

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA 90230. (Past issues have many articles on access control systems).

INSTRUCTIONAL LEARNING SYSTEMS

22.2

TELEPHONE ACCESS CONTROL

Goal:

The apprentice will be able to describe telephone access control.

Performance Indicators:

1. Describe function of digital dialers in telephone access control.
2. Describe telephone use for remote access control.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Digital communicator
- Digital dialers
- Digital keypad
- Voice grade telephone line

Introduction

The original concept of access control was to station a guard at the points of access. Live guards are expensive in today's labor market. The problems of access control becomes more complex with increased numbers of people and vehicles. Instead of one guard and one gate, a single monitor may be required to control several access points. The monitor may be nearby the point of access or at a remote site.

The ability to transmit digital signals down voice grade phone lines has opened up many new possibilities in access control. Telephone access control can now be handled from points far removed from the point of access.

Information

The telephone can be utilized as an access control device. Digital dialers (digital communicators) use voice grade telephone lines to communicate digital signals. Through the use of digital dialers, a Seattle real estate man could open the gate of a Florida estate by use of a digital communicator. Digital communicators offer many options in remote control of access.

Traditional devices of access control can be used with the telephone. The digital dialer is used to transmit the signals from where access is requested to where access is approved.

For example, a motorist drives to a gate and punches in an identification number on a digital keypad. Those numbers become digital signals which travel by telephone lines to the number that controls access. If the identification number is a valid one, digital signals are sent back along the telephone lines to the gate mechanism. Those signals are converted into electro-mechanical energy to actuate the gate operator. The gate opens and the motorist enters the controlled area. If their I.D. number is not valid, the gate remains closed.

Digital dialers make telephone access control feasible. Costly metallic lines are not necessary with digital dialers. The digital signals can be transmitted on voice grade telephone lines.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check answers.

Job Sheet

REVIEW SUPPLY CATALOG

- Obtain an up-to-date supply catalog.
- Study equipment specifications for access control equipment.
- Study specifications for equipment used in transmission of signals by telephone.
- Compare the recommended equipment for its applications in telephone access control.

Self Assessment

1. What device is needed to transmit digital signals through voice grade telephone lines?

2. Why is telephone access control appropriate for remote controlled situations?

Self Assessment Answers

1. Digital dialers or digital communicators.

2. Voice grade phone lines can be used. This eliminates the need for costly wiring.

Post Assessment

1. Why are digital dialers important to telephone access control systems?

2. Why are voice grade telephone lines more economical than direct wired metallic lines?

Instructor Post Assessment Answers

1. Digital signals can be trasnmitted.

2. Direct wired lines are expensive to install. Voice grade lines already exist in most locations.

Supplementary References

- Local phone company.

INSTRUCTIONAL LEARNING SYSTEMS

22.3

COMPUTERIZED CONTROLS AND INTERFACES

Goal:

The apprentice will be able to describe computerized access control and interface equipment.

Performance Indicators:

1. Describe computer managed alarm system.
2. Describe parts of a computer system.
3. Describe interface equipment.
4. Describe applications of computer systems.

Study Guide

- Read the goal and performance indicator for this package.
- Read the vocabulary list. Take notice of the trade terms that will be used in this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Vocabulary

- Central processing unit (CPU)
- Communication processor
- Computer interface control
- Digital computer processor
- Display
- Input/output
- Interface control
- TDM (Time division multiplexing)
- Terminal keyboard
- Transponder

Introduction

The computer is causing an explosion of technology. It is being used in all aspects of life and is becoming a household device. The introduction of microcomputers have made computer technology available to most Americans.

The computer saves people time in performing routine operations. It can be linked with other electronic devices through the use of interface equipment. This allows the digital computer to receive many types of outputs and deliver outputs in a number of formats.

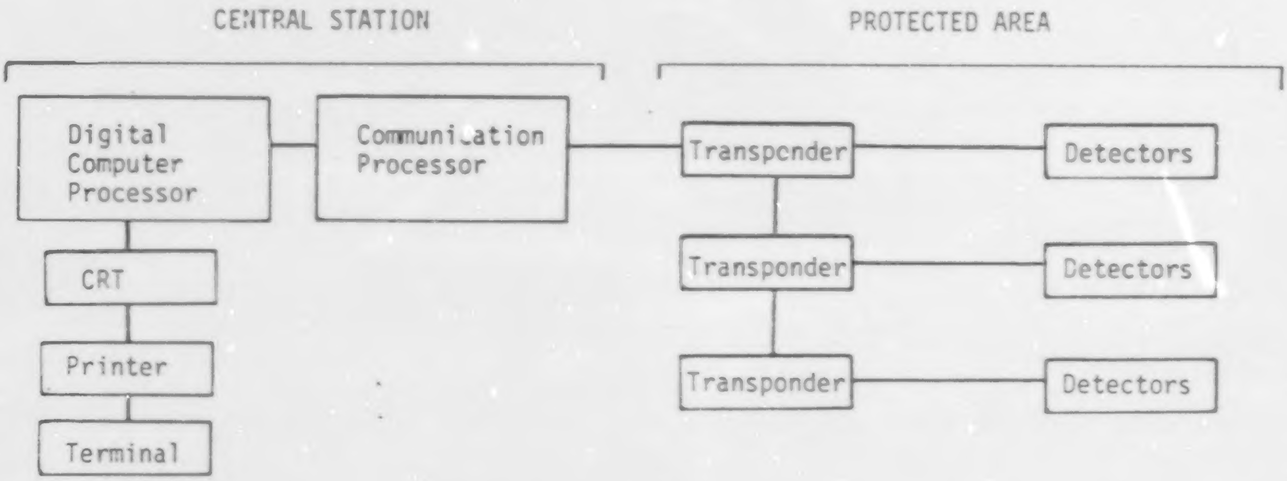
The security alarm systems can be managed by a computerized control. As systems become more complex, the computer will become even more useful. An installer should understand computerized control systems and their applications in the alarm field.

Information

A computerized access control system includes:

- Terminal keyboard for making input.
- Display such as CRT, printer or slide projector.
- Communication processor that communicates with the transponders of the protected area.
- Digital computer processor.
- Transponders to monitor the detectors.
- Detectors in the protected area.

A block diagram of a computerized access control system is shown below.


CENTRAL STATION
PROTECTED AREA
Digital Computer Processor
Communication Processor
CRT
Printer
Terminal
Transponder
Transponder
Transponder
Detectors
Detectors
Detectors

Each communication processor will handle the signals from several transponders. Each transponder handles the signals from detectors in one area of protection.

Input/Output

Data can be entered into the processor by a keyboard-terminal, punch cards, magnetic

Information

tape or through a communication processor. Likewise, the output of a processor may be placed on tapes, disks, CRT, slide projector or printer.

Computer interface control allows the processor to communicate with people. Interface devices are needed for converting digital signals into print and visual displays of information.

Display

The CRT (Cathode Ray Tube) is a screen display of information. It is one of the most common form of displays. Hard-copy printers provide a written record of the information and can be combined with CRT displays. In closed circuit television systems the monitoring screen can be controlled by computer interface equipment.

Most computerized systems use more than one form of display.

Communication Processor

The communication processor operates on a TDM (Time Division Multiplexing) system. Each transponder is assigned an identification number. The processor interrogates the transponders and asks for a status report. The transponders reply that the protected areas are either secure or alarm status. Each transponder is interrogated in the TDM time sequence. The communication processor sends this status report on to the digital computer processor. The communication processor is located in the central station.

Digital Computer Processor

The computer processor may be a microcomputer or a central main frame computer. A computer processing unit has three basic functions:

1. Memory to store data and instructions for processing data.
2. Input/output to move data into the computer and out to a display.
3. Central processing unit interprets instructions, sequences data and combines input and memory information.

Transponder

A transponder monitors the signals from the detectors in the protected areas. Each transponder is interrogated about its status in the sequence of the time divisions of the multiplex system. Any alarm signals are reported at the time of interrogation. The transponder is capable of receiving signals from the detectors and transmitting signals to the CPU.

Information

Detectors

A wide range of detection devices can be managed in a computerized system of access control. Computers can be used to operate door strikers, lights and environmental controls along with security systems. Where CCTV is used, the pans, tilts and zoom lens control can be computer operated.

Interface Control

Interface devices allow us to hook many other prices of equipment into a computer system. For example, a printer must be interfaced with a computer because one is using a binary language and one is writing in English. The interface devices are extremely important to success of a computerized alarm system. The interface must be properly synchronized with the CPU to get good results. The computer has been developed for several years. Most of the recent efforts have been to develop good interface devices. The interface devices make the computer a practical and usable system.

Applications

Computers are used to manage control systems for intrusion and fire alarms; control openings and closings of buildings; operate CCTV access control systems and control of the environment. Many security measures are routine and can be programmed into a computer. Door openings and closings are one example. This can be programmed and will save considerable time for staff.

Computers can be programmed to control who enters a facility. Card access controls, voice prints, fingerprint controls and other systems can be interfaced with a central processing unit. The computer can also control the time of entry into a facility.

Assignment

- Read pages 237-243 in the supplementary reference.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

VISIT A COMPUTER MANAGED ACCESS CONTROL SYSTEM

- Arrange a visit to a station that uses computer control.
- Ask for a general explanation of the system.
- Ask questions about features that were not covered in the explanation. Make sure that you have an understanding of:
  - Devices being managed by the system.
  - Location and numbers of transponder units that are controlled by system.
  - How the communication processor works in the total system.
  - Where the CPU is located.
  - How the signal information is displayed.
  - Types of interface equipment needed to operate the system.
  - Advantages, disadvantages and problems with the system.

Self Assessment

1. What is the prupose of an interface device?

2. How does a CRT display information?

3. List three forms of outputs from a computer?

4. A communication processor uses a type of multiplexing to interrogate the transponders. What is the type of multiplexing used?

5. A transponder communicates whether a protected area is alarm or status.

6. What is a CPU?

7. What operations can a computer perform for a CCTV system?

8. Which device monitors the detectors?

9. Which types of services can be computer managed along with security alarms?

10. List two ways that a computer can take inputs.

Self Assessment Answers

1. Allows other expressions to be made from binary language of computer. Example: Printers, CRT.

2. On a screen.

3. Tapes, disks, slide projector, CRT, printer.

4. TDM (Time Division Multiplexing)

5. Secure

6. Central processing unit.

7. Manage system for pan/tilt control, zoom lens control, scanner control.

8. Transponder.

9. Environmental controls, opening and closing of doors, CCTV control.

10. Terminal, tapes, disks.

Post Assessment

1. List the major parts of a computerized access control system.

2. What device is used to monitor the detectors?

3. List two forms of computer input.

4. List two forms of computer output.

5. What is the full name of a CRT?

6. A device that converts digital signals into print and visual displays is called an ________________ control.

7. List two functions of CCTV that can be controlled by a computer.

8. Which multiplexing system is used in a communication processor?

9. What are the three basic functions of a computer?

10. What are the two modes of security that can be reported by a transponder?

Instructor Post Assessment Answers

1. Digital computer processes, communication processor, transponder, detectors.

2. Transponders

3. Keyboard terminal, punch cards, magnetic tape or through a communication processor.

4. Tapes, disks, CRT, printer, slide-projector.

5. Cathode Ray Tube.

6. Interface.

7. Zoom lens control, pan/tilt control, scanner control.

8. Time Division Multiplexing (TDM)

9. Memory, input-output, central processing unit.

10. Alarm, secure.

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers. Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

22.4

KEY ACCESS CONTROL

Goal:

The apprentice will be able to describe key access control and its application.

Performance Indicators:

1. Describe key system for access control.
2. Describe applications of key access control systems.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list to learn new trade terms.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check your own answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

* Controllock system
* Master key
* Release key
* Starter key

Introduction

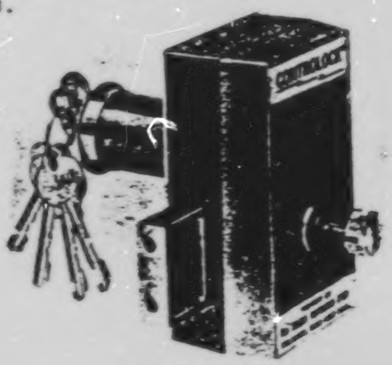
The traditional lock and key system offer very little protection against a skilled burglar. The burglar has skill in opening locks. Security alarm systems have moved toward card access controls and digital key systems to get the needed protection.

Keyed switch locks can be very effective in access control. The keys must be part of a system and linked with the alarm system. Installers must understand how to use keyed locks and their applications in alarm systems.

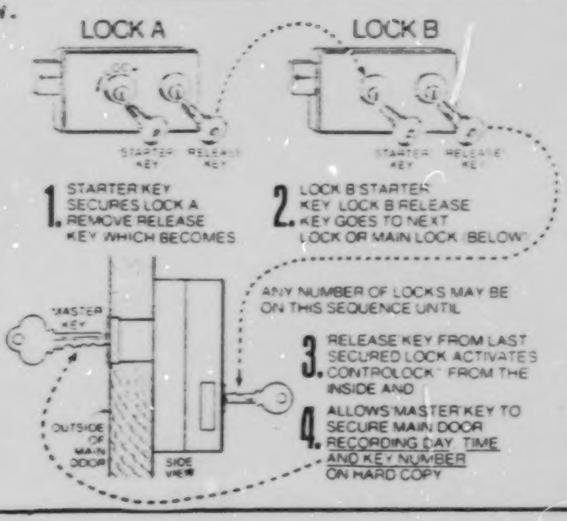
Information

The control of access by keys has been greatly improved in the last few years. At one time access was one lock and one key. Later the use of master keys allowed a person to open many locks with one key. Some systems have been developed to make keys into an effective control method.

An example of key control is the Controlock System which is built by the Silent Watchman Company of Columbus, Ohio.


CONTROLOCK

Each key that is issued to employees identifies the holder of the key. The lock on the main door is connected with a recorder. When the lock is turned, it records the day, time and key number on hard copy. The controlock works with a starter key and a release key. When the starter key is turned, it releases the release key. The release key becomes the starter key on the next lock. Any number of locks may be on this sequence. The last lock in the series activates the controlock from the inside and allows the master key to secure the front door. A diagram of the system is shown below.


LOCK A
LOCK B
STARTER KEY
RELEASE KEY
STARTER KEY
RELEASE KEY
1. STARTER KEY SECURES LOCK A REMOVE RELEASE KEY WHICH BECOMES
2. LOCK B STARTER KEY LOCK B RELEASE KEY GOES TO NEXT LOCK OR MAIN LOCK (BELOW)
ANY NUMBER OF LOCKS MAY BE ON THIS SEQUENCE UNTIL
3. RELEASE KEY FROM LAST SECURED LOCK ACTIVATES CONTROLOCK FROM THE INSIDE AND
4. ALLOWS MASTER KEY TO SECURE MAIN DOOR RECORDING DAY TIME AND KEY NUMBER ON HARD COPY
MASTER KEY
OUTSIDE OF MAIN DOOR
SIDE VIEW

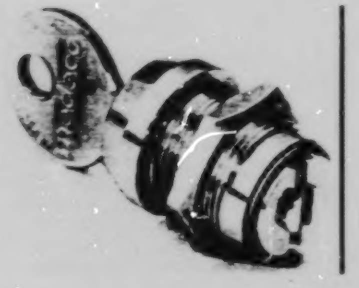
COPY AVAILABLE

Information

TYPES OF SWITCH LOCKS

Switch locks are made to function as on/off, shunt and momentary switches. The on/off type switch lock arms and disarms the alarm system. A shunt switch removes a portion of the protective system from the circuit to allow entry into a protected area with an alarm. Momentary switches allow a delay time so that the system can be armed and the person will have time to exit the area before it alarms.

Switch locks are classified as round key, rotary, flat key, pick-resistant and cam locks. They can be purchased according to the positions in which the key can be removed from the lock. Some keys are removable in the make position and others in the break position. Keys are also sold according to their circuit description. The key switches are described as 2 or 3 pole switches and the number of positions on the switch. A security rotary lock is shown in the following picture.



SECURITY ROTARY SWITCH LOCKS

The security of the control unit of a burglar alarm system, can be greatly enhanced by the addition of a Medeco Rotary Switch Lock. Functions of the lock may be varied to encompass many different applications. Ideal as a function switch for any burglar alarm control.

HOW TO ORDER

LOCK & 2 KEYS	FUNCTION
60-1000	360° No Stop Key Pulls In Positions 1 thru 5

APPLICATIONS

The sequence locking system can be built into an alarm system. When the last lock is secured, the alarm will be activated. An owner can monitor opening and closing times and after hour access by employees. This feature has been a big saver for firms that have problems with employee theft. Some companies use the controlock to monitor their area supervisors visits to individual stations. Each area supervisor is issued a letter key and is told to cycle the controlock on each visit. It leaves a record of the date and time of visit and the hours spent at the station.

The tape from a controlock has become court evidence in many cases of employee theft. When employees know that they are being monitored, it reduces the temptation of theft.

There are many applications for key control systems with a sequence locking system.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

EXAMINE A SWITCH LOCK

- Obtain one or more examples of keyed switch locks.
- Turn key in lock and observe movements.
  - How many switching positions do you observe?
  - At which positions can the key be removed from the lock?
  - Can you find the contacts?
- Read the manufacturers recommendations for installation and use of switch.
  - Do you understand the recommendations?
  - Can you install this switch in a system?

• Self Assessment

1. What is the purpose of a shunt switch?

2. List two other functions (other than shunt) of key switch locks?

3. List three classes of switch locks?

4. What is a sequential locking system?

5. Why is a hard-copy record of locking dates and times important in security systems?

Self Assessment Answers

1. Remove a portion of the system from the circuit.

2. On/off and momentary functions.

3. Round, flat, rotary, cam and pick-resistant.

4. Uses a starter key and a release key. One key must be turned before the other will work.

5. Prevents employees from after-hour visits to business. If they do enter at unauthorized times, the record will identify the person by their individual key identification.

INSTRUCTIONAL LEARNING SYSTEMS

Post Assessment

1. A ______________________________ switch removes a portion of the system from the circuit.

2. A _________________________ switch delays the arming while the owner makes an exit from the protected area.

3. The controlock system uses a starter key and a ____________________ key in a locking sequence.

4. How can we determine who used a key to make entry into a protected area?

5. List four types of switch locks according to their general classification.

Instructor Post Assessment Answers

1. Shunt
2. Momentary
3. Release
4. By the hardcopy record. Each key holder is identified on their key.
5. Round, flat, cam, pick-resistant, rotary.

Supplementary References

* Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. 90230.

INSTRUCTIONAL LEARNING SYSTEMS

22.5

VEHICULAR ACCESS CONTROL

Goal:

The apprentice will be able to describe vehicular access control systems.

Performance Indicators:

1. Describe use of live guards.
2. Describe door and gate operators.
3. Describe mechanical lock and digital key systems.
4. Describe coded cardkey access systems.
5. Describe voice identification systems.
6. Describe CCTV remote control.
7. Describe magnetic sensors.

Vocabulary

- CCTV remote control
- Cipher locks
- Coded cardkey
- Digital key
- Door/gate operator
- Magnetic sensor
- Voice identification

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Introduction

Access control is an ever-increasing problem. More and more people and vehicles are moving about than at any time in the past. With this influx of people and cars, crime and vandalism have become a major problem. In order to carry on an orderly business, many firms must control the flow of traffic that enters and leaves their premises. Parking is one part of the vehicular access problem.

This package will introduce the apprentice to some concepts of vehicular access control. The control systems range from very simple ones to highly sophisticated systems. The greater the security threat, the more complex the system will become. Experience will lead the apprentice into these complex systems.

Information

Vehicular access control involves the same devices that are used in other types of access control systems. Those devices may be:

- Live guards
- Door/gate operators
- Mechanical locks using keys or cipher locks
- Coded cardkey systems including magnetic, fingerprint, etc.
- Voice identification
- Remote control systems using CCTV
- Magnetic sensors that trigger gate mechanism when cars pass over them

Live Guards

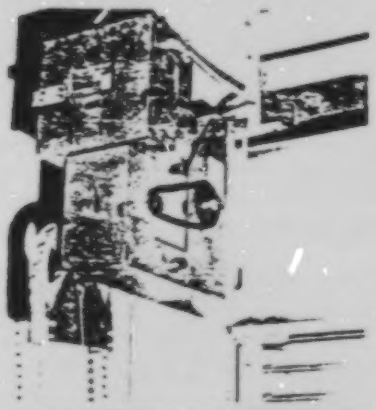
Many parking and vehicular accesses are controlled by live guards. The motorist must present I.D. to the guard before entering the controlled access area. Live guards and dogs are the oldest forms of access control.

Door/Gate Operators

Electric door and gate openers can be controlled by coded cardkey to allow authorized access. The motorist inserts the cardkey into a reader which confirms their right to access. These door and gate operators can handle very heavy doors and gates. The operators can be purchased as light commercial or heavy duty types. A picture of a door and gate operator mechanism is shown.

DOOR AND GATE OPERATORS HELP THWART THEFT AND VANDALISM

A complete line of industrial and commercial electric door, gate and grille operators to control access is available from Stanley Vemco, Detroit, MI.



The operators are available for use with heavy duty and standard hi-lift or vertical lift doors; slide and swing gates; heavy, rolling steel curtains; rolling grilles; sliding doors and barrier gates. One-, two- and three-button manual operation is standard; automatic operation is optional.

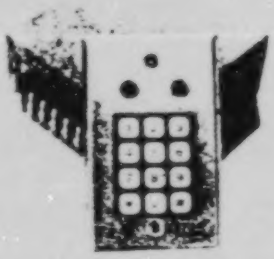
Operators are available for doors up to 440 square feet—from light commercial operators to heavy-duty, three-button jackshaft operators.

PRODUCT INFO., CIRCLE 270, READER SERVICE CARD

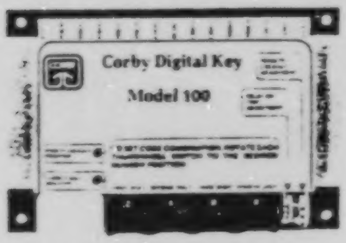
Information

Mechanical Locks

Mechanical locks for vehicular access control are of two types. The locks may be operated with keys or by cipher locks. Cipher locks require that proper keys be punched in sequence in order to open a gate. A cipher lock is controlled electronically. A cipher lock system is shown in the following photograph.



Digital key systems are miniature computer systems that operate doors and gates. These systems are set according to codes and offer 10,000 combinations of coding. A digital key system is shown.



DIGITAL KEY SYSTEM

New Model 100 Digital Key System, available from the Electronics Division of Corby Industries, Inc., Whitehall, PA, utilizes integrated circuits to furnish the user with a pickproof electronic key that can operate at any voltage, six to 24 volts, AC or DC.

Coded Cardkey Access

Coded cardkey access has been discussed in detail in other packages. A driver must insert a cardkey into a reader to gain access to an area. The reader can read a code number for the authorized motorist and open an access gate or door. Handprints and fingerprints may also be used as identification on a coded cardkey system. The levels of security threat will determine how sophisticated the system will be. The magnetic stripe is the most basic type of cardkey identification.

BEST COPY AVAILABLE

Information

Voice Identification

Voice identification is one type of access control. Pre-recordings of voices of authorized persons are matched against voices requesting access to an area. The computer makes the match and either allows or denies access. In practice, a motorist drives up to a speaker and gives their name. Their voice is matched with a pre-recording. If the voice characteristics match, the gate is opened electronically.

CCTV Remote Control Systems

CCTV systems may be used to control access at remote locations such as parking lots. The driver pulls up to a gate and looks into the CCTV camera and shows an I.D. badge. A security guard monitors the CCTV at some central site. If the driver matches photographs and I.D. with those on the guard's list of authorized personnel, the guard then opens a gate by remote control.

Magnetic Sensors

Traffic lights are often controlled by magnetic sensors. When a vehicle pulls up to an intersection, a magnetic sensor lets the light know that someone is waiting and the light will turn green. Airport parking lots use magnetic sensors to open barriers at parking lot entrances. The car pulls up; a ticket is dispensed to the driver; and the barrier is lifted. After the car passes under the barrier, it is lowered to get ready for the next vehicle.

Assignment

- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have instructor check your answers.

Job Sheet

OBSERVE A CONTROLLED ACCESS ENTRY

- Visit a site that has controlled access entry, i.e. government facility, factory, parking lot, airport.
- Observe how vehicular access is controlled.
  - Are magnetic sensors used to announce the arrival of a vehicle? i.e. Tickets coming out of machine.
  - Are identification cards required?
  - How is identity verified? i.e. handprint, fingerprint, photograph, number on magnetic stripe

Self Assessment

1. A lock that requires keys to be punchwed in sequence is called a _________________________ lock.

2. A key system that actually involves a miniature computer to process the combination codes is a ____________key system.

3. What is the most common identification method found on coded cardkeys?

4. What alerts the traffic light to change when your car rolls up to an intersection?

5. Which control device is most often used in remote control systems?

Self Assessment Answers

1. Cipher

2. Digital

3. Magnetic stripe

4. Magnetic sensor

5. CCTV

Post Assessment

1. What is a common device that opens gates for control access?

2. Digital key systems offer some ____________________ combinations of coding.

3. List three types of identification used in coded cardkey access systems?

4. The barriers at entrances to airport parking lots are actuated by ________________ sensors that react to the vehicle.

5. ______________________ locks require that proper keys be punched in sequence in order to open a gate.

Instructor Post Assessment Answers

1. Gate operator
2. 10,000
3. Magnetic stripe code, fingerprint, handprint, photograph
4. Magnetic sensors
5. Cipher

Supplementary References

- Security Distributing and Marketing. P.O. Box 272, Culver City, CA. 90230.

INSTRUCTIONAL LEARNING SYSTEMS

23.1

TELEPHONE SERVICES

Goal:

The apprentice will be able to describe telephone services for alarm system operation.

Performance Indicators:

1. Describe telephone rate structure.
2. Describe tariff.
3. Describe repair orders.
4. Describe RJ 31 X jack.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- AT & T (American Telephone and Telegraph)
- Public Utility Commissioner
- RJ 31 X phone jack
- Tariff

Introduction

Security alarm systems are becoming highly dependent upon telephone lines as carriers of the signals. Digital communicators have made it possible to carry alarm signals on voice grade telephone lines. The alarm systems are becoming a part of regular telephone services.

An apprentice needs to know some of the basic requirements of telephone rates, tariffs and hookups. For effective service, a good relationship must be developed with local telephone companies.

Information

How are rates determined?

Dedicated phone lines are leased from the telephone company. Rates for leased lines are determined by the Public Utility Commissioner. Digital communicators operate on ordinary phone lines. The regular telephone rates apply to these systems whether the lines are used to operate alarm systems or a business phone. These rates are determined by the telephone company.

What is a tariff?

The rules and regulations that cover utilities is called a tariff. Tariffs may be a thick book of rules and regulations that govern all telephone utilities or it may be a single rule that applies to security alarm systems. The Public Utility Commission administers the tariffs on telephone use. At this point in time, there are few tariffs that specifically impact the security alarm field. The tariff specialist at the Public Utilities Commission indicated that a new tariff has been submitted for the use of digital communicators as of March 1984.

How are telephone repair orders handled?

The security alarm company has a special number to call for repairs that involve security alarm transmission. Responses by telephone repairmen will vary from one phone company to another. It is dependent on the relationship between the phone company and the security alarm firm. Security alarm companies do much of the repair that relates to their alarm systems. This trend is the result of delays in getting their systems restored through telephone repair orders. The servicing of telephone systems has become more complex since the breakup of AT and T. Now the local telephone company installs jacks and lines but will not repair the phone itself. The phones are either individually owned or leased from AT and T.

What types of connections are required?

The FCC (Federal Communications Commission) now permits direct connection of FCC registered equipment to the telephone line by standard plugs and jacks. Telephone company couplers are no longer required.

The No. 620 Direct Connect Cord includes the plug to be used. It plugs into a telephone company supplied and installed USOC (Universal Service Order Code) No. RJ31X or RJ38X Jack.

The No. 620 must be used to "direct connect" equipment that has line seizure

Information

capability (i.e. automatic disconnection of handsets from the telephone line during equipment activation) such as:

No. 663 Line Seizure/Switching Module
No. 669 Digital Communicator
No. 670 Digital Communicator
No. 674 Select-A-Line

Equipment that does not utilize line seizure may be direct connected via the No. 620 and "RJ" Jack as described in Diagram 1. Alternatively, where local regulations permit, a standard 4 pin telephone plug and jack may be used. Such equipment includes:

No. 612 Automatic Telephone Dialer
No. 660 Digital Receiver
No. 671 Digital Call Director
No. 679 Digital Communicator

OPERATION: (See Diagram)

No. 620 plugged into "RJ" Jack: Connection of the handsets to the incoming line can be controlled by the equipment attached to the No. 620.

No. 620 unplugged from "RJ" Jack: Handsets are connected directly to the incoming line via "shorting bars" within the jack. Protection equipment is disconnected from line.

GENERAL SPECIFICATIONS:

Plug : Miniature, 8 Position, Keyed
Conductors : 8
Jacket : Chrome Vinyl
Length : 7' (2.1 meters)
Termination : U-Lugs

Mates with : USOC (Universal Service Order Code)
No. RJ31X or RJ38X Jack (Miniature 8 Position) to be ordered from and installed by telephone company

Information

The installation instructions for Ademco No. 620 Direct connect cord into a RJ31X or RJ38X Jacks are shown in the following diagrams.

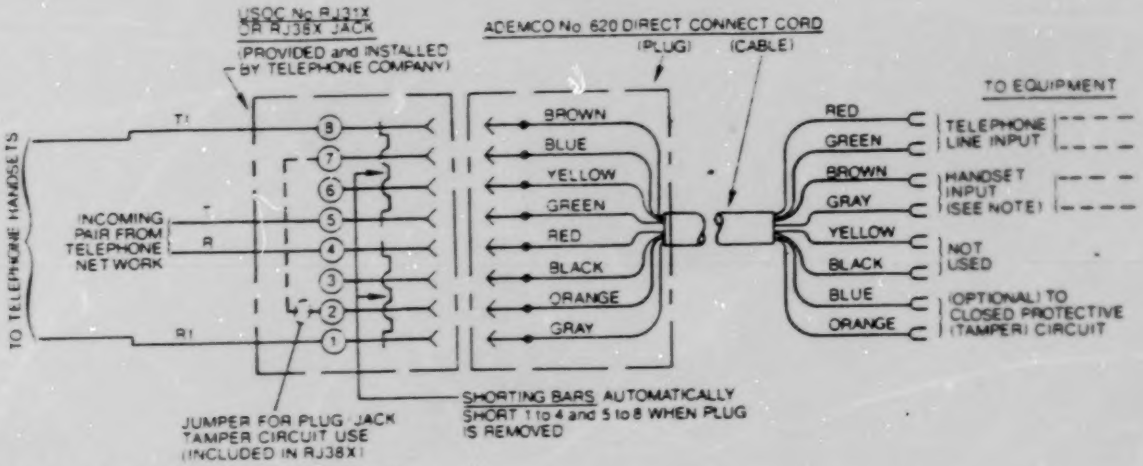
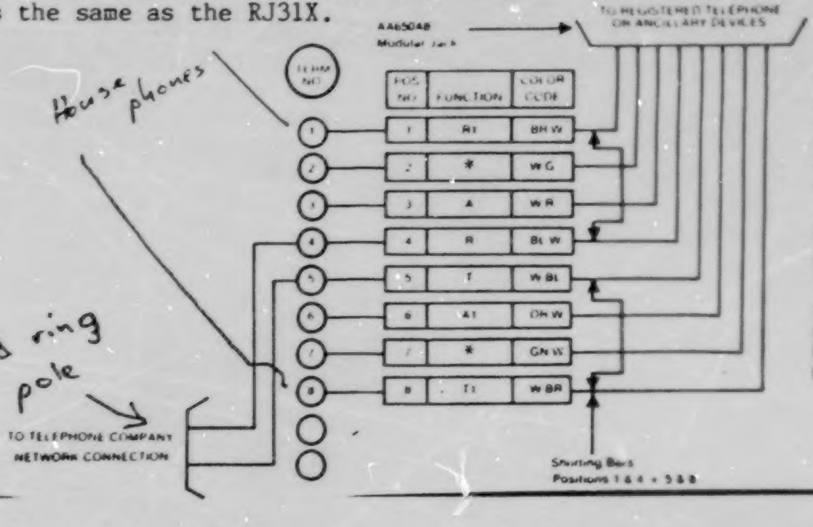

USOC No RJ31X
OR RJ38X JACK
(PROVIDED and INSTALLED BY TELEPHONE COMPANY)
ADEMCO No 620 DIRECT CONNECT CORD
(PLUG)
(CABLE)
TO EQUIPMENT
TO TELEPHONE HANDSETS
T1
INCOMING PAIR FROM TELEPHONE NETWORK
T
R
R1
8
7
6
5
4
3
2
1
BROWN
BLUE
YELLOW
GREEN
RED
BLACK
ORANGE
GRAY
RED
GREEN
BROWN
GRAY
YELLOW
BLACK
BLUE
ORANGE
TELEPHONE LINE INPUT
HANDSET INPUT (SEE NOTE)
NOT USED
(OPTIONAL) TO CLOSED PROTECTIVE (TAMPER) CIRCUIT
JUMPER FOR PLUG/JACK TAMPER CIRCUIT USE (INCLUDED IN RJ38X)
SHORTING BARS AUTOMATICALLY SHORT 1 to 4 and 5 to 8 WHEN PLUG IS REMOVED

DIAGRAM 1: Wiring and Typical Connections

The RJ31X is provided and installed by the telephone company. The functional wiring of an RJ31X jack is shown in the following diagram of an AA635A connecting block which is the same as the RJ31X.


AA650AB Modular Jack
TO REGISTERED TELEPHONE OR ANCILLARY DEVICES
TERM NO
POS NO
FUNCTION
COLOR CODE
1
R1
BR W
2
*
W G
3
A
W R
4
R
BL W
5
T
W BL
6
A1
OR W
7
*
GN W
8
T1
W BR
TO TELEPHONE COMPANY NETWORK CONNECTION
Shorting Bars Positions 1 & 4 + 5 & 8

House phones

tip and ring in from pole

BEST COPY AVAIL AB

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Job Sheet

OBSERVE THE CONNECTIONS INTO AN RF31X PHONE JACK

- Arrange to observe a journeyman make connections into an RJ31X Jack.
- Record the steps in the installation.
  - Techniques
  - Wire identificaiton
- Testing

Self Assessment

1. Who sets the rates on leased telephone lines?

2. Which rates are used for digital communicators?

3. Where are the tariffs for telephone communications found?

4. What type of jack is needed for hooking alarm systems into telephone lines?

5. How are repair orders handled?

Self Assessment Answers

1. Public Utility Commissioner

2. Regular telephone rates

3. Public Utility Commission

4. RJ31X

5. By calling a special number at the telephone company.

Post Assessment

1. What is a RJ31X?

2. What is a tariff?

3. Who sets the rates on leased lines?

4. Who determines the rates for digital communicators?

5. Who owns or leases telephones at present?

Instructor Post Assessment Answers

1. A special phone jack used in installation of alarm systems.

2. A set of rules and regulations that govern telephone services. It is kept by Public Utility Commissioner.

3. Public Utility Commissioner

4. Telephone companies regular rates

5. A T and T

Supplementary References

- Public Utility Commissioner
  Labor and Industries Building
  Salem, Oregon 97310
  Contact: Jack Bosch
  Tariff Manager
  Telecommunications Division
  Telephone: 378-6635

- Local Telephone Company
  Business Office

INSTRUCTIONAL LEARNING SYSTEMS

24.1

BASIC SOUND SYSTEM

Goal:

The apprentice will be able to describe a basic sound system.

Performance Indicators:

1. Describe transmitter.
2. Describe amplifier.
3. Describe receiver.
4. Describe loudspeaker.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Amplifiers
- Audio frequencies
- Audio frequency amplifier
- Baffle
- Cone
- Hertz
- Loudspeaker
- Microphone
- Output transformer
- Resistance couplings
- Speaker
- Transmitter
- Tweeter
- Voice coil
- Woofer

Introduction

Sound systems are part of many detection systems. Schools often use public address systems as the basis for audio detection or sound discrimination devices. A basic sound system consists of a transmitter, amplifier and receiver.

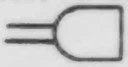
An apprentice should have a basic knowledge of how a sound system operates. They shiould know its parts and how they relate to each other. This package provides a general description of a sound system and how it works.

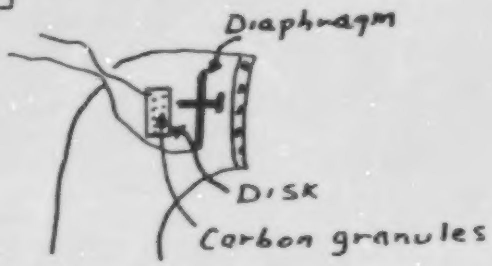
Information

A basic sound system is composed of the following parts.

- * Transmitter that accepts the sound and converts it to electrical energy that can be transmitted down a line. As sound as made it creates vibrations. Those vibrations that can be heard by the human ear are called audio frequencies. Humans hear frequencies of 20 to 20,000 hertz. Hertz refers to cycles per second of the sound vibrations. a microphone is a transmitter.
- * Amplifiers are used to magnify the sound so that it can be heard. The amplifier increases the strength of the signal being transmitted.
- * Speaker or Loudspeaker is a receiver that processes the signal and reconverts it to voice quality sound.

Transmitter

A telephone transmitter consists of a round, flexible diaphragm connected to a small container of carbon. When voice waves hit the diaphragm it moves with the vibrations of the sound. This vibration causes movement in the carbon. If this setup is connected with a battery, the current will vary according to the sound waves. This variation changes the sound vibrations into electrical waves that can be transmitted. A transmitter and microphone are the same. The symbol of a microphone is  . A telephone microphone is shown below:



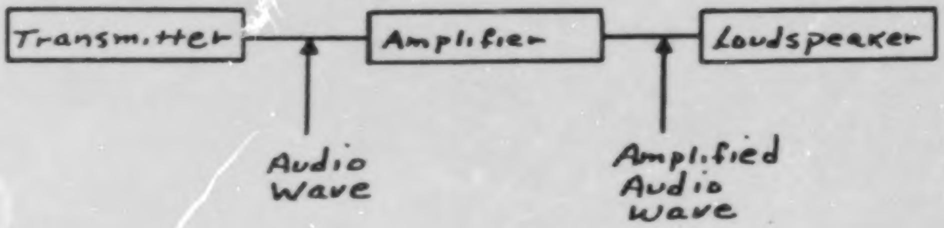
All other microphones work on a similar principle.

Amplifiers

The purpose of amplifiers is to make signals stronger. The signals produced by a transmitter are weak and need to be magnified for ease of hearing at the receiver end. An audio-frequency amplifier is used to make audio signals

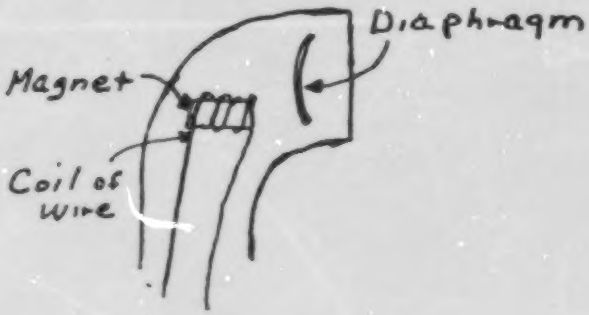
Information

stronger. In one scheme, the transmitter is connected to an amplifier by a resistance and capacitor coupling. This is known as resistance couplings. A diagram of an audio amplifier in a total sound system is shown.


Transmitter
Amplifier
Loudspeaker
Audio Wave
Amplified Audio Wave

Receiver

A receiver transfers electric current back into sound waves. A receiver consists of a magnet with a coil of wire around it and with a flexible diaphragm mounted in front of it. A telephone receiver is an example:


Diaphragm
Magnet
Coil of Wire

Loudspeakers

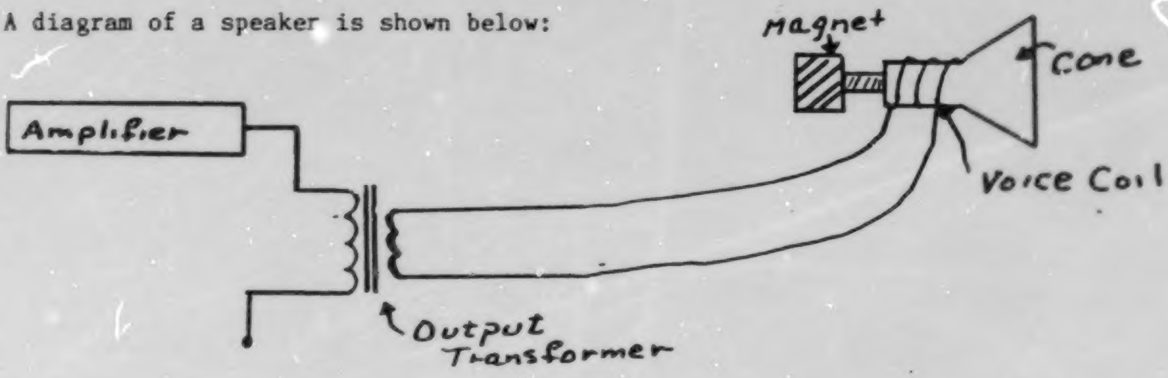
A loudspeaker unit contains a permanent magnet. The loudspeaker consists of:

* Voice coil which is a coil of wire wound on a hollow tube at the base of the cone.

Information

- Cone that produces sound waves.
- Output transformer that couples the amplifier to the speaker.
- Magnet that sets up a magnetic field in the voice coil.

A diagram of a speaker is shown below:


Magnet
Cone
Amplifier
Voice Coil
Output Transformer

A loudspeaker system which handles high frequencies is called a tweeter. One that handles low frequencies is called a woofer. The box surrounding a loudspeaker is referred to as a baffle.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and check answers with instructor.

Job Sheet

INSPECT A SOUND SYSTEM

* Carefully inspect a sound system and identify the following.

  - Microphone or Transmitter

    Do you find the diaphragm that receives the sound waves? Do you find the location of the carbon grains that help to convert sound into electrical energy?

  - Amplifier

    Does it have a resistance and capacitor coupling with the amplifier? What does the unit look life?

  - Speaker

    Is it a woofer or tweeter? Where is the magnet located? Do you find the voice coil? Does it have a transformer? What type of baffle is found?

Self Assessment

1. The cylces per second of sound vibrations is called ____________________.

2. Sound vibrations that can be heard by humans is called ____________________ frequency.

3. Sound energy is converted to electrical energy by the ____________________.

4. Electrical energy is converted back into sound energy by the ______________.

5. A loudspeaker that handles high frequencies is called a ________________.

Self Assessment Answers

1. Hertz
2. Audio
3. Transmitter
4. Receiver or Speaker
5. Tweeter

Post Assessment

1. An ______________________ is used to make audio signals stronger.

2. A loudspeaker system that handles low frequencies is called a _________________________.

3. The box surrounding a loudspeaker is called a __________________________.

4. Draw the symbol of a microphone.

5. A ____________________________ is used to change sound waves into electrical current.

Instructor Post Assessment Answers

1. Amplifier

2. Woofer

3. Baffles

4.

5. Transmitter or microphone

Supplementary References

- Basic references in electronics will provide additional information as needed. Manufacturers information and supply catalogs are another good resource for specific information on sound systems.

INSTRUCTIONAL LEARNING SYSTEMS

25.1

BUSINESS LETTERS

Goal:

The apprentice will be able to describe the parts and format of a business letter.

Performance Indicators:

1. Describe parts of a letter.
2. Describe format of a letter.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list for this package.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have your instructor check the answers.

Vocabulary

- Body
- Closing
- Conclusion
- Date
- Inside address
- Introduction
- Salutation

Introduction

Businesses communicate in a number of ways. The most common methods of communcation is through business letters and telephone conversations. Both forms of communication are vital to success in a business.

Business letter writing is a simple process if a format is followed in writing the letters. The letter format must become habit with the writer.

This package explains the parts of a business letter and shows examples of those parts in example letters.

Information

A business letter should be concise, clear and neatly written. Well written letters usually get a positive response from the receiver.

Parts of a Business Letter

Letterhead should be used for company business. It looks more official and businesslike. The name and address of the receiver should form the inside address. It is wise to use titles in the headings because some receivers may prefer it that way. A date should be typed on the letter on the opposite side of the page. A salutation can be Dear Mr. Jones, Dear Tom or Ms. Irene Dunn. The salutation should be appropriate to the receiver. If you do not know for sure that the receiver is a Mrs. or a Miss, the Ms. prefix should be used. If you know the receiver is proud of the title of Dr., use it in the salutation. After all, a business deal may hinge on how well you please them.

An introduction is used to establish a reference point for the message that you wish to convey. It does not include the message but sets the stage for the message.

The body of the letter is used to convey the message. It should be clearly stated so that the reader can understand it. Lengthy, rambling sentences are not good in a business letter. The reader gets lost and rejects the idea that is being conveyed.

The conclusion of a letter is used to summarize the points in the message and make proposals for the future. It is a wrap-up of the message that you were trying to convey in the body of the letter.

The closing of a letter is a Sincerely, Yours truly, Respectively Yours, etc. followed by the signature of the letter sender. The closing is equal to a so long or goodbye, have a nice day that occurs when two people end a business discussion. The closing should be as courteous as though you were stating a verbal goodbye. It leaves the reader with a positive feeling toward the sender. In business, positive feelings and responses are most important.

Information

Purpose of Business Letters

Business letters are written for various reasons. Some of the most common reasons are:

* Provide information to a customer or client.

* Clarify financial transactions.

* Request information from others.

* Public relatinos with customers and potential customers.

Writing the Letter

The letter should be written in the same style that you would use in a verbal communication. In order to show the parts of a business letter in the context of actual letters, two example letters are given in this package. The apprentice should follow the format of these letters and write their own. Only practice will make a good letter writer. It can be a pleasure to communicate ideas through business letters. Good letters are good public relations for the letter sender. For this reason, the process of letter writing must be continually improved.

INFORMATION LETTER

LETTERHEAD

JOHN DOE COMPANY
Frechnglen, Oregon 97203
Telephone: (503) 682-7312

DATE WRITTEN

January 16, 1984

Mr. Jack Daniels
Smoke Detectors, Inc.
2302 S.W. Pine Street
Bend, Oregon 97801

NAME AND ADDRESS OF RECEIVER

Dear Mr. Daniels:

SALUTATION

In regard to our telephone conversation on December 28, I am sending the information that you requested.

INTRODUCTION

The new smoke detector (Model 621) is an ionization type detector that is far more sensitive than any of the previous models. It offers the advantage of early detection of smoke which allows a response force to suppress a fire before it does extensive damage. The disadvantage of this detector is false alarms created by cigarettes and other small quantities of smoke that may be a natural part of the environment.

BODY OF LETTER

The price of this detector is $18.43 which is competitive with other smoke sensing units.

I have included a brochure that shows pictures and specifications for the 621 detector unit. Also, an order blank is provided for your convenience.

CONCLUSION

If I can be of further help in this matter, please call or drop by our office.

CLOSING

Sincerely,

SIGNATURE

NAME OF SENDER

JIM DOE, PRESIDENT

PUBLIC RELATIONS LETTER

JOHN DOE COMPANY
Frenchglen, OR 97203

January 16, 1984

Mr. James Beam
700 Hazy Lane
Fossil, OR 97256

Dear Jim,

Our company wishes to express its appreciation for your purchase of the fire alarm system. It is nice to become acquainted and establish friendships with new customers. It is personally rewarding to our staff as well as being financially advantageous to our company.

We would like to help you with your alarm system needs in the years to come. If we cannot supply your needs with quality products at competitive prices, we can certainly refer you to fellow suppliers that can fill your orders.

Once again, thanks for doing business with our firm.

Sincerely,

JIM DOE, PRESIDENT

Assignment

- Complete job sheet.
- Complete self assessment.
- Complete post assessment.

Job Sheet

- Write business letter requesting information from a supply company or manufacturer.

Self Assessment

1. Write a short business letter for the purpose of conveying product information to a customer.

2. Identify parts of letter to assure that it is complete.

Self Assessment Answers

- Does the letter have:
  - Inside address
  - Date
  - Salutation
  - Introduction
  - Body
  - Conclusion
  - Closing

Post Assessment

- Write a short letter to clarify a financial transaction with a customer that believes you have cheated him.

Instructor Post Assessment Answers

- Have the instructor read and comment on your letter.
  - Did you fully explain the financial matter?
  - Is the letter written in a way to appease or make him madder?

Supplementary References

- Business letter files.

INSTRUCTIONAL LEARNING SYSTEMS

26.1

VIDEO SURVEILLANCE SYSTEMS

Goal:

The apprentice will be able to describe video surveillance systems.

Performance Indicators:

1. Describe one camera surveillance system.
2. Describe multiple surveillance systems.
3. Describe field of view systems.

Study Guide

- Read the goal and performance indicators to find what is to be learned from package.
- Read vocabulary list of trade terms.
- Read introduction and information sheets for technical information.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete post assessment and have instructor check answers.

Vocabulary

- Camera
- Coaxial cable
- Electronic switches
- Enclosures
- Field of view
- Fixed focus lens
- Housing
- Image tube
- Image splitting optics
- Lens
- Long focal length lens
- Monitor
- Multiple camera system
- Pan/tilt
- Short focal length lens
- Silicon target
- Single camera system
- Standard vidicon camera
- Video signal
- Wide field of view
- Zoom lens

Introduction

Closed circuit television has been around for many years. It has taken a long while for it to become part of our everyday living.

The economic slump has helped to promote a boom in closed circuit television in the security industry. Security staff have been replaced with CCTV systems in order to trim budgets.

A wide variety of cameras and other CCTV equipment has flooded the markets. The cost of CCTV systems are becoming more economical.

The installer must be able to select cost effective equipment for a CCTV system. This means that an installer must know basic equipment types and characteristics.

Information

SINGLE-CAMERA SYSTEMS

A basic closed circuit television system is composed of:

- Lens which collects light from the scene and forms an image of the scene on the camera tube.
- Camera which converts the visible scene into an electrical signal that is suitable for transmission over a coaxial cable.
- Coaxial cable which transmits the camera scene signal from the camera to a monitor.
- Monitor which displays the picture that the camera is taking by converting the electrical signal back into a visible picture.

The system described above is a one-camera system. In one-camera systems, an installer should consider the following questions.

- Where should the camera be located so that all people in the doors and lobby can be viewed?
- In what direction should the camera be pointed so that sun and opening doors have the least effect?
- Should the camera have 2/3" or 1" diameter image tube?
- What field of view should be covered?
- Should a fixed focus lens or zoom lens be used?
- How much lighting is available for daytime or nighttime operation?
- Should the camera be mounted on wall brackets, recessed in walls or ceiling or installed in a housing?
- What is the distance between camera and monitor?
- What size monitor screen should be used?
- How is the monitor connected?
- Should the camera voltage be 115 V AC or 24V DC?

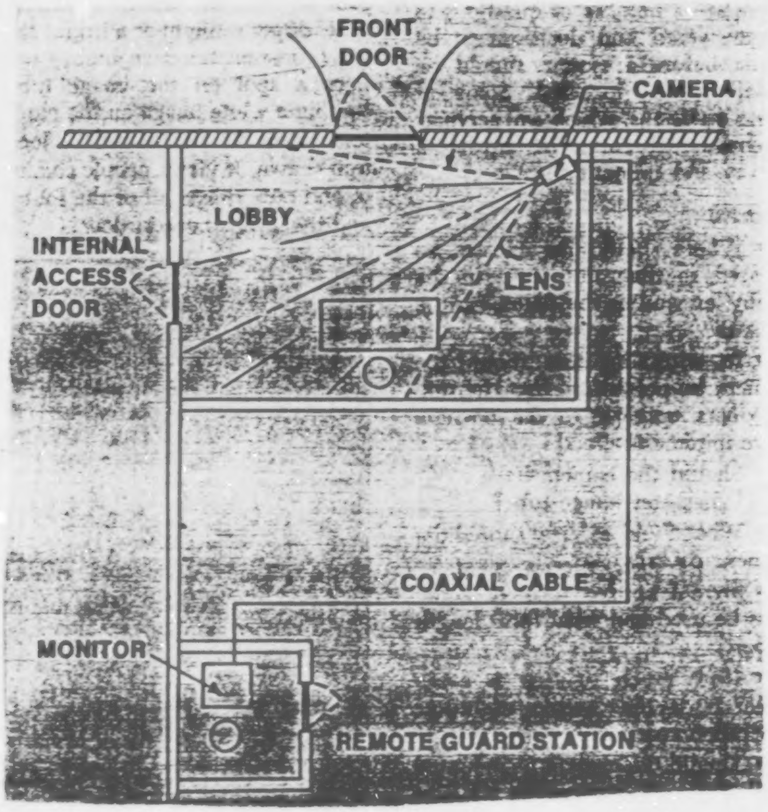
Information

- What type of coaxial cable should be used? RG59 or RG11?
- Is the monitor desk top or rack mounted?

This package will explain some of these points. The next packages in this series will provide specific details on cameras, lenses, monitors and enclosures.

CAMERA LOCATION

The camera should not be pointed toward the sun or an open door. Large light levels will hurt the picture quality. In some cameras, bright sunlight will burn a spot on the image tube. A good camera location that will view people moving through the doors and lobby is shown below.


FRONT DOOR
CAMERA
LOBBY
INTERNAL ACCESS DOOR
LENS
COAXIAL CABLE
MONITOR
REMOTE GUARD STATION

BEST COPY AVAILABLE

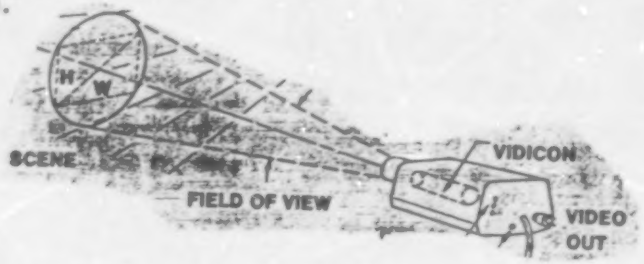
Information

IMAGE TUBE SIZE

All standard cameras use either 2/3" or 1" diameter image tubes. If cost is a major factor the 2/3" tube should be selected. Where image quality is the major consideration, the 1" tube should be selected.

FIELD OF VIEW (FOV)

The field of view is the scene that the camera sees. A light source (sunlight or lamps) illuminate the scene. Part of this light is reflected to the lens of the camera. The camera collects the light through the lens and focuses it onto the image tube. The image tube converts the visible image into electronic signals. A video signal is transmitted by coaxial cable to the video monitor. A field of view is shown in the following diagram.



TYPE OF LENS

The field of view is determined by the type of lens used. A short focal length lens has a wide field of view. A long focal length lens has a narrow field of view. Lenses will be of two types:

- Fixed focal length lens
- Zoom lens

The fixed focal length lens must be selected to match the specific requirements of a job. A zoom lens has a variable focal length. Zoom lenses are more expensive than fixed focal length lenses. The zoom lens allows many field of views with one lens. Lenses will be discussed in detail in a separate package.

SCENE LIGHTING

The standard vidicon camera will function in most situations where a normal amount of light is available. In cases where the camera must face bright lights or sunlight, a vidicon with a silicon target should be used. The silicon tube is more sensitive (10 to 100 times) than the standard tube. It is also more expensive. Other types of cameras are designed for use in dim light. The camera types will be dealt with in detail in a separate package.

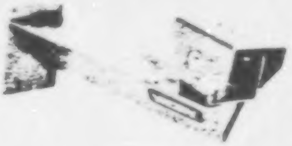
Information

CAMERA INSTALLATION

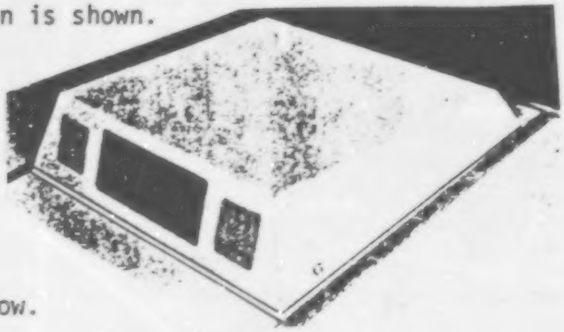
A camera may be installed in one of three ways:

- Mounted on a simple camera bracket.
- Recessed in the wall or ceiling.
- Placed in attractive housings or enclosures that provide protection from the environment and vandalism.

A simple mounting bracket is shown below.



A ceiling enclosure for a recessed installation is shown.



A housing for an indoor camera is pictured below.

Information

CAMERA POWER

Most cameras operate from 115 volt or 24 V power. If 115 volt is available at the camera site, it should be used. If a camera is to be operated at a remote location, a step-down transformer will be needed.

COAXIAL CABLE

The RG 59 and RG 11 coaxial cables transmit both camera power and video signal. If cameras are located in remote areas, one cable can be used for both needs. The details of cable selection and connectors will be dealt with in a separate package.

MULTIPLE CAMERA SYSTEMS

Once single camera systems are understood, it takes very little more to understand multiple camera systems. There are two remaining questions that are specific to multiple camera systems.

- Will a single monitor be enough for each camera?
- Will the picture from each camera switch into a single display monitor by an electronic switcher.

This will depend on the preference of the customer and the number of people moving through the camera areas. If a large number pass through an area, all cameras should use separate monitors. If only a few people move about the area, a single monitor and switcher should be used.

WIDE FIELD OF VIEW SYSTEMS

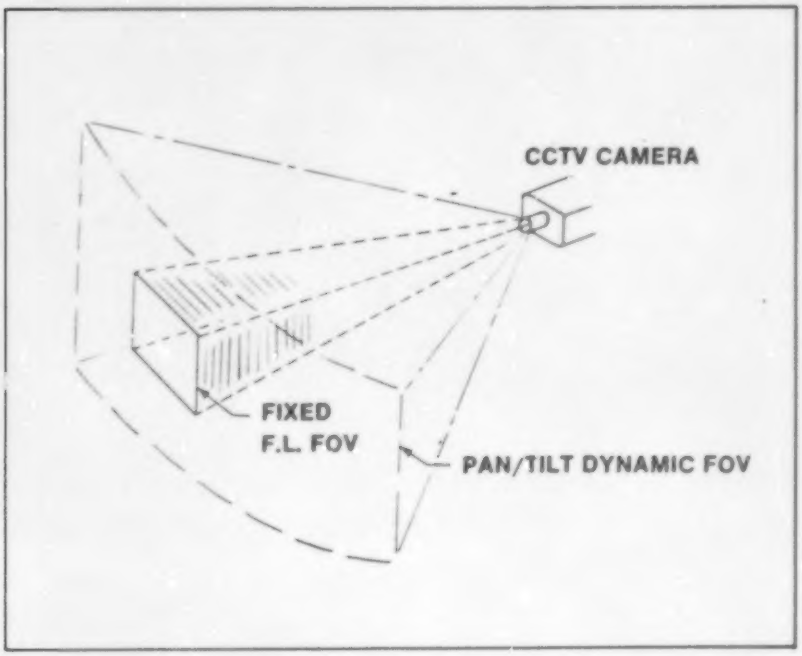
The applications of wide fields of view can be made with:

- Pan/tilt platforms.
- Multiple cameras to break a wide area into smaller fields of view.
- Fixed, wide field of view lens on a standard camera.

A pan system allows the camera to move horizontally. A tilt system moves the camera up and down. A pan/tilt platform requires motors, switches and timers to move the camera.

A pan/tilt field of view is shown in the following picture.

Information


CCTV CAMERA
FIXED
F.L. FOV
PAN/TILT DYNAMIC FOV

Information

WIDE FIELD OF VIEW CAMERA

Several techniques are used in getting a wide field of view.

- 110 degree FOV
- 180 degree FOV

The 110 degree FOV is obtained by using a 4.8 mm lens. This system is used in lobbys and elevators. The 180 degree FOV requires two 100 degree lenses. The lenses we mounted at 90° angles to each other, one on top of the other. One monitor handles both lenses. A 180 degree FOV camera system is shown.

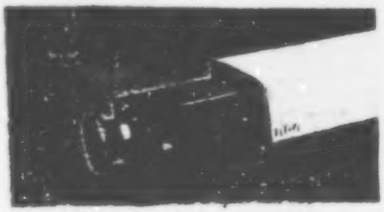
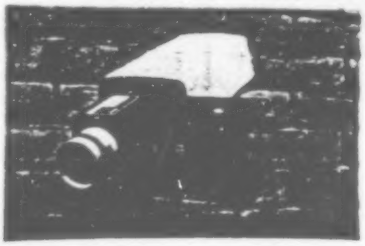


IMAGE SPLITTING OPTICS

Image splitting involves displaying more than one camera scene on a single monitor. This may be done with:

- Two cameras, two cables, an electronic splitter and one monitor.
- One camera, one splitter and one monitor.

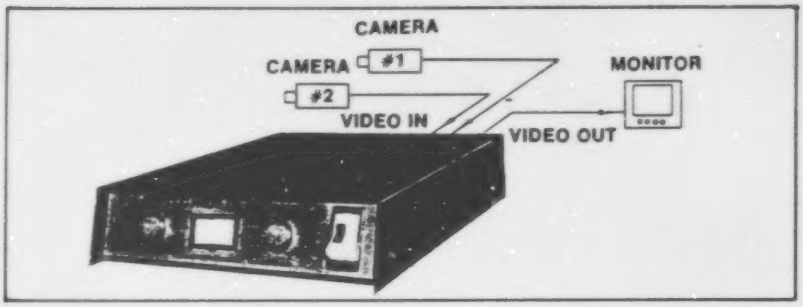
A small optical splitter is screwed into the camera "C" mount. Two lenses are then screwed into the splitter. This causes the two scenes to be displayed in a split image on the monitor. The camera views one scene and the splitter lens views another. The twinlens image splitting optics is shown below.



Information

SWITCHERS

Electronic switchers can be used to display several camera scenes on one monitor. Each camera's scene is shown in turn on the monitor. Indicator lights show which camera is being displayed. A switcher system is pictured below.


CAMERA
#1
CAMERA
#2
VIDEO IN
MONITOR
VIDEO OUT

Assignment

- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check your answers.

Job Sheet

EXAMINE CCTV SYSTEMS

- Visit a supply house with a variety of CCTV equipment and supplies.
- Make a list of equipment types available and prices.
  - Cameras
  - Coaxial cable
  - Coaxial connectors
  - Lenses
  - Switchers
  - Monitors

INSTRUCTIONAL LEARNING SYSTEMS

Self Assessment

1. The ____________ collects light from a scene and forms an image on the camera tube.

2. The ____________ ____________ transmits the camera scene to the monitor.

3. What might happen if a camera is pointed at strong light?

4. Would you expect the best image quality from a 2/3" or 1" image tube?

5. Which part of the camera converts visual images into video signals?

6. A lens with a variable focal length is called a ____________ lens.

7. A long focal length has a _________ field of view.

8. Why are comeras placed in housings and enclosures?

9. What is a switcher used for?

10. ________________ optics allow more than one camera to display on a single monitor.

Self Assessment Answers

1. Lens

2. Coaxial cable

3. Might burn the image tube.

4. 1"

5. Image tubes

6. Zoom

7. Narrow

8. To protect from environmental conditions and vandalism.

9. To allow more than one camera to display on a single monitor.

10. Image splitting.

Post Assessment

1. A __________ image tube is less expensive of the two standard sizes.

2. What is used to transmit the camera scene to the monitor?

3. The scene that a camera sees is called a ____________ ____________ ________________.

4. The image tube converts visible images into ______________ signals.

5. What is a zoom lens?

6. A short focal length has a __________ field of view.

7. Can 115 volt power be used with CCTV camera?

8. A pan system allows camera to move ______________.

9. A device that allows several camera scenes to be shown on one monitor is an electronic ________________.

10. Both camera power and video signals can be transmitted on the same types of ____________________ ____________________.

Instructor Post Assessment Answers

1. 2/3"
2. Coaxial cable
3. Field of view
4. Video signals
5. One with a variable focal length
6. Wide
7. Yes
8. Horizontally
9. Switcher
10. Coaxial cable

Supplementary References

- Security, Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA 90230. (Several past issues have good articles on CCTV systems.)

INSTRUCTIONAL LEARNING SYSTEMS

26. 2

CCTV CAMERAS

Goal:

The apprentice will be able to describe closed circuit television cameras.

Performance Indicators:

1. Describe types of CCTV cameras.
2. Describe parts of CCTV cameras.
3. Describe sync of cameras.
4. Describe resolution.
5. Describe light sensitivity and compensation.
6. Describe application of CCTV cameras.

Study Guide

- Read the goal and performance indicators. Determine what is to be learned from this package.
- Read the vocabulary list of new trade terms to be introduced in this package.
- Study the introduction and information sheets to get the technical information.
- Complete the job sheet.
- Complete the self assessment and check your own answers with answer sheet.
- Complete the post assessment. Ask the instructor to check your answers.

Vocabulary

- Compensation
- Composite video
- Enclosures
- Housings
- Image tube
- Interlace
- Lines of resolution
- Photoconductor
- Picture field
- Random interlace camera
- Silicon diode
- Silicon intensifier target camera (SIT)
- Sync
- Vidicon

Introduction

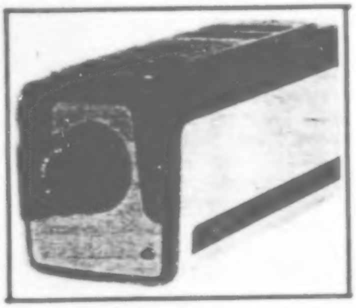
Cameras are the basic component of a closed circuit television system. Careful selection of a camera is the most important step for a successful system.

CCTV cameras have a wide range of applications in video surveillance systems. The silicon image tube provides greater sensitivity to light. Systems can now be installed to give 24 hour surveillance.

Information

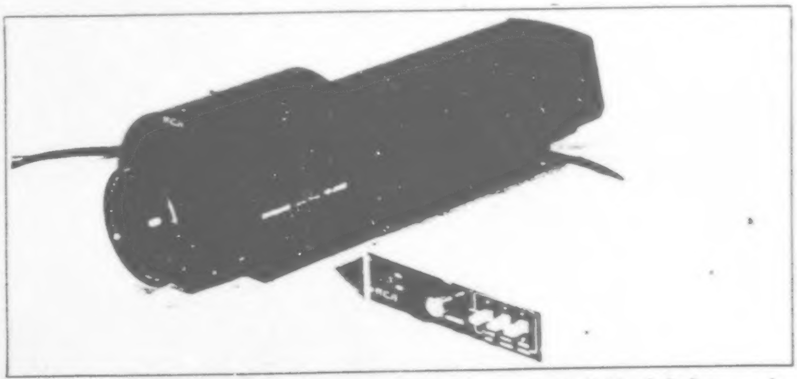
BASIC CCTV CAMERAS

The basic CCTV camera for security purposes is the low cost random interlace surveillance camera. These cameras have a wide light range which make them suitable in many applications. These cameras are of solid state construction. A random interlace camera is shown below.



SPECIAL CCTV CAMERAS

The silicon intensifier target camera (SIT) is used as a 24 hour surveillance. This camera can transmit images in near darkness. The SIT camera has been refined even further in the ISIT camera. It can operate in even darker settings. A SIT camera is pictured below.



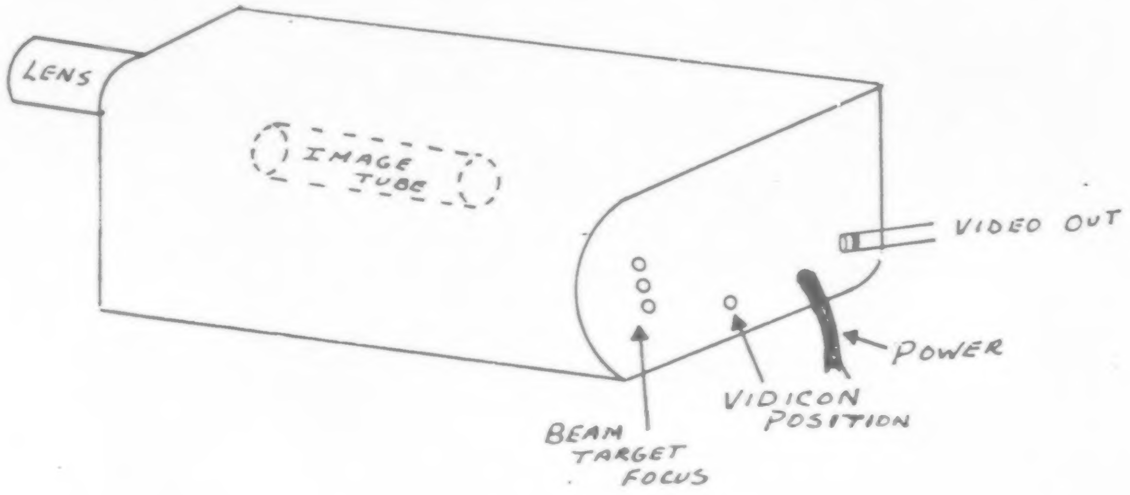
SIT Camera will produce crisp, useful TV pictures right up to threshold of darkness — in light levels as low as 0.0001 footcandles of scene illumination.

OPY AVAILABLE

Information

PARTS OF A CCTV CAMERA

The basic parts of a CCTV camera are shown below.



Lens --	Collects light from the scene and forms an image of scene on the vidicon (image tube)
Vidicon -- or Image Tube	Converts the visible scene into a video signal.

SYNC OF CAMERA

The camera must have the ability to "lock up" with the monitor in a way that produces stable pictures. That ability is called sync. The camera must send video signals and sync information to the monitor. About .7 of the total signal is video signal and .3 is sync information. The video signal goes from ground reference and is positive. Sync pulses are negative. Video signals and sync information together are called composite video.

A picture video is made up of two fields of information. Each field is transmitted in 1/60 of a second. To reduce the flicker in pictures, one field of information fills in between the scan lines of the other field. A picture field is made by

Information

scanning 262 horizontal lines. The beam scans 262 lines down and then scans 262 lines up. Each direction makes one picture field. When the lines of the second field falls exactly between the lines of the first field, the interlace is 2:1. Random interlace cameras do not provide a complete sync between the two fields. The sync is close enough to give acceptable pictures.

LINES OF RESOLUTION

A frame of picture information contains 525 lines. Each picture field is 262½ lines. The two picture fields make up one frame. Each line is scanned in the transmission of a signal. The number of lines scanned by a camera is known as lines of resolution. The random interlace camera gives pictures with 525 lines of resolution. Home TV sets are limited to 250 lines of resolution.

LIGHT REQUIREMENTS

The random interlace camera can operate with as little as .5 foot-candles of scene lighting. In other words, these cameras can operate in the dim lighting of buildings. A bright sunlight scene is about 8,000 foot-candles of light. A dim interior of a room is 1 foot-candle. The variation in the two light levels is 8,000:1. This ratio will be called compensation in camera specifications. Compensation tells us the range of light conditions that the camera will work in. For example, a camera with a 10,000:1 compensation will perform in a very wide range of light conditions--bright sunlight to dim hallways. The silicon vidicon camera is designed for low light levels. When the lighting is apt to affect picture quality, a silicon intensifier target (SIT) camera should be used.

HOUSINGS AND ENCLOSURES

There are many types of housings and enclosures for CCTV cameras. The cameras can be mounted on a bracket or recessed into the wall or ceiling. Housings are often selected to give a better appearance to the unit. Other types of housings and enclosures offer protection from vandalism, dust and other environmental conditions.

VIDICON TUBES

The image tube is a critical part of a CCTV camera. The standard sizes of image tubes are 2/3" and 1". The 2/3" tubes are less expensive but do not give as good an image quality as the 1" tube. The 1" tube offers a higher resolution and greater sensitivity to light.

Standard vidicons consist of a photoconductor that is made with antimony trisulphide. The more light sensitive vidicons are made with silicon diodes. Silicon diode tubes

Information

are 5 to 10 times more light sensitive than the standard image tubes.

APPLICATIONS

Most cameras have solid state components. In most cases, the manufacturer takes care of camera repair. The installer does not need to be a camera technician or a TV photographer. The installer of CCTV should know:

- How to select the proper camera.
- How to locate a CCTV camera to get the maximum field of view.
- How to connect camera and monitor.
- How to design and install multiple surveillance systems.
- How to make external adjustments of camera and monitor.

Assignment

- Complete job sheet.
- Complete self assessment.
- Complete post assessment.

Job Sheet

OBSERVE TYPES AND COSTS OF CCTV CAMERAS.

- Visit a store that sells CCTV equipment.
- Look closely at the cameras.
  - Standard random interlace types.
  - SIT and ISIT types.
  - Image splitting optics.
  - Special wide field of view cameras.
- Compare costs of standard surveillance cameras and those designed for special purposes.
- Compare cameras by reading the specification sheets.
  - Lines of resolution.
  - Light sensitivity and compensation.

• Self Assessment

1. What is the basic camera used for security purposes?
2. What is the advantage of SIT cameras?
3. The tube that converts visible scenes into video signal is called a ____________________.
4. The ability of a camera to "lock up" with the monitor and give a stable picture is called ____________________.
5. A picture field has ___________ lines of information.
6. A frame has _____________ lines of information.
7. The ratio of light (10,000:1) is called ______________________.
8. A ________________" vidicon tube offers better resolution and sensitivity than the 2/3" tube.
9. _______________ diode image tubes are 5 to 10 times more light sensitive than the tubes made with antimony trisulphide.
10. Bright sunlight produces about ________________ foot-candles of light.

Self Assessment Answers

1. Random interlace
2. Work at very low levels of light
3. Vidicon or image tube.
4. Sync
5. 262½
6. 525
7. Compensation
8. 1"
9. Silicon
10. 8,000

• Post Assessment

1. How many scan lines make up a picture field?

2. How many scan lines make up a frame?

3. What is an SIT camera?

4. What is sync?

5. What are lines of resolution?

6. What is compensation?

7. What is the preferred size of image tube for best resolution and sensitivity to light?

8. What is the advantage of a silicon diode image tube?

9. A video signal is ______________________.
(Positive, negative)

10. Sync pulses are ______________________.
(Positive, negative)

Instructor Post Assessment Answers

1. 262½

2. 525

3. Has a silicon intensifier target (SIT) which allows it to function in very low light.

4. The ability of a camera to "lock up" with the monitor in a way that produces a stable picture.

5. The number of the total (525) lines scanned by the camera.

6. A term that describes the ratio of light sensitivity of a camera. It is a ratio that compares the light of bright sun and dim light. Compensation describes range of light that a camera can work within.

7. 1"

8. Can function in very low light.

9. Positive

10. Negative

Supplementary References

- *Security, Distributing and Marketing Magazine*. P.O. Box 272, Culver City, CA. 90230. (Past issues contain many good articles on CCTV.)

INSTRUCTIONAL LEARNING SYSTEMS

26.3

CCTV CABLE

Goal:

The apprentice will be able to describe types of CCTV cable and its application.

Performance Indicators:

1. Describe coaxial cable.
2. Describe applications of coaxial cable.

Study Guide

- Read the goal and performance indicators. Determine what is to be learned from package.
- Read vocabulary list to learn new trade terms to be discussed in package.
- Read introduction and information sheets.
- Complete the job sheet.
- Complete self assessment and check your answers.
- Complete post assessment and have instructor check your answers.

Vocabulary

- Black vinyl
- BNC connectors
- Coaxial cable
- Connectors
- Clamp type connector
- Crimp type connector
- Impedence
- Insulation
- Jacket
- Polyethylene
- Shield
- Signal Wire
- UHF connectors

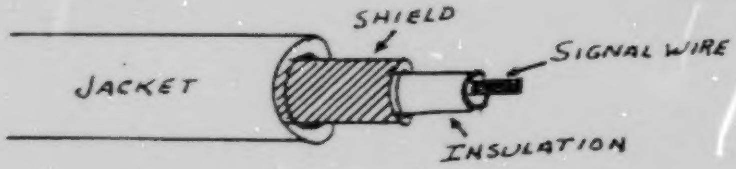
Introduction

Coaxial cables are necessary for carrying high grade video signals from a camera to the monitor. The cable received its name from a shield of copper material that is wound coaxially about the wire.

This package is designed to help apprentices understand coaxial cable and its applications in video surveillance systems.

Information

COAXIAL CABLE is a special type of cable for conducting video signals. A coaxial cable has a coaxially located shield around it. An insulation separates the wire that carries the signal from the shield.



Coaxial cable comes in standard lengths of 25, 50, 100, 500 and 1,000 feet. The signal carrying wire is made of stranded copper or copper covered steel. The insulation between the wire and shield is made of polyethylene. Outside cable jackets are black vinyl. The shield is made of a copper material.

CABLE SIZES

Coaxial cable sizes have 22 gauge wire. The wire may be a solid copper or stranded wire. The wires can be purchased in a variety of impedences. Impedence rating is designated by numbers on the coaxial cable. Such numbers as R59U tell us that the cable belongs to a group with certain measures of resistance. Most CB radios and television transmitters use 22 gauge wire.

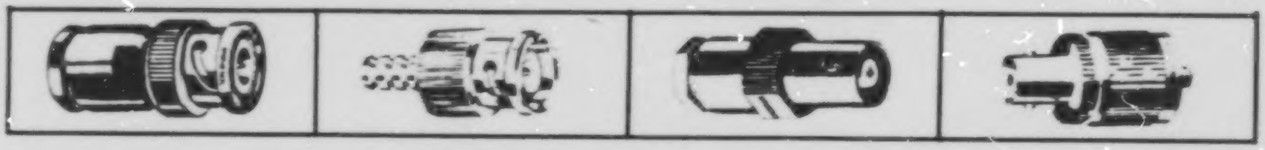
COMMON TYPES OF CCTV CABLE

The most common types of CCTV cable are RG 59 U and RG 11 V. Both of these numbers are cables with 75 ohms of impedence. One cable is needed for each camera because only one picture is transmitted per camera.

CONNECTORS

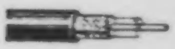
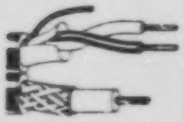
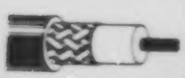
Connectors can be purchased in two basic types -- UHF and BNC. The connectors may be either crimp or clamp types. This refers to the way the connectors are attached to cable. The connectors may also be male or female types. These features can be seen in the following pictures of BNC connectors.

Information



CABLE SPECIFICATIONS

A look at the following RG 59 V cable specifications will give an understanding of sizes, parts and characteristics of CCTV cable.

DESCRIPTION	NUMBER	STANDARD LENGTHS (FEET)	AWG (STRANDING)	SHIELD	INSULATION	JACKET
	8241	25 50 100 U-500 500 U-1000 1000	22 (solid) bare copper covered steel	1 bare copper 95% coverage	Polyethylene	Black Vinyl
	9240	U-500 500 U-1000 1000	20 (solid) bare copper covered steel	1 bare copper 80% coverage	Cellular Polyethylene	Black Vinyl
	9265	500 1000	2 cond. 22 (stranded) tinned copper 1 coax. 22 (stranded) bare copper	1 pair Beldfoil 100% coverage 1 bare copper 95% coverage	Vinyl Cellular Polyethylene	Black Vinyl
	9259	50 100 U-500 500 U-1000 1000	22 (stranded) bare copper	1 bare copper 95% coverage	Cellular Polyethylene	Black Vinyl

Information

APPLICATIONS

Some rules should be followed in working with coaxial cable.

1. Long runs should be made with a single length of cable. Avoid splicing in the middle of a run.
2. Follow manufacturers recommendations. Use recommended cable for the job. Manufacturers will specify the maximum allowable distance between camera and monitor.

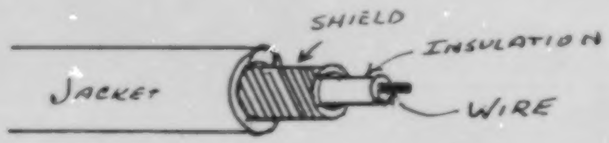
Assignment

- Complete job sheet.
- Complete self assessment and check answers.
- Complete post assessment and have instructor check answers.

Job Sheet

INSPECT A PIECE OF COAXIAL CABLE AND CABLE CONNECTORS

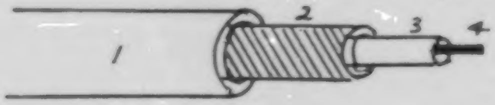
- Obtain a piece of coaxial cable and cable connectors.
- Expose the layers of the cable by cutting it like this.



- Is the wire solid core or stranded?
- Do you find all of the parts?
- Examine the cable connectors
  - Are the connectors UHF or BNC?
  - Are the connectors crimp or clamp types?
  - Are the connectors male or female types?

Self Assessment

LABEL THE PARTS OF THIS COAXIAL CABLE:



1. ______________________

2. ______________________

3. ______________________

4. ______________________

5. What are signal wires made from?

6. What are jackets made from?

7. What is the shield made from?

8. Most coaxial cable has _______ gauge wire?

9. Connectors come as UHF and _______ types.

10. RG 59 V cable has _____ ohms impedence.

Self Assessment Answers

1. Jacket
2. Shield
3. Insulation
4. Signal wire (center wire)
5. Copper or coppered covered steel
6. Black vinyl material
7. Copper material
8. 22
9. BNC
10. 75

INSTRUCTIONAL LEARNING SYSTEMS

Post Assessment

DRAW AND LABEL THE FOLLOWING PARTS OF A COAXIAL CABLE

1. Jacket

2. Shield

3. Insulation

4. Signal wire

ANSWER THE FOLLOWING QUESTIONS:

5. How many ohms of resistance (impedence) does an RG 59 V cable have?

6. What is the wire size of coaxial cable used in CCTV?

7. What types of connectors are used with coaxial cable?

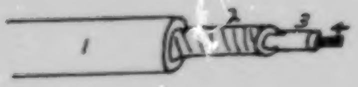
8. Is it proper to splice in the middle of a run of coaxial cable?

9. What is the signal wire made from?

10. What is the shield made from?

Instructor Post Assessment Answers

1. Jacket



2. Shield
3. Insulation
4. Signal wire
5. 75 ohms
6. 22 gauge
7. UHF and BNC
8. No
9. Copper or copper coated steel
10. Copper

Supplementary References

- *Security Distributing and Marketing Magazine*. P.O. Box 272, Culber City, CA. 90230 (Past issues.)

INSTRUCTIONAL LEARNING SYSTEMS

26.4

CCTV MONITORS AND RECORDERS

Goal:

The apprentice will be able to describe monitors and recorders and their applications.

Performance Indicators:

1. Describe monitors.
2. Describe time lapse recorders.
3. Describe time/data generator.
4. Describe inserter/splitter devices.
5. Describe applications of monitors and recorders.

Study Guide

- Read the goal and performance indicators. Find out what you are supposed to learn from the package.
- Read the vocabulary list.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check your answers.
- Complete the post assessment and have the instructor check your answers.

Vocabulary

- Desk-top monitor
- Horizontal tearing
- Inserter/splitter
- Rack mounted monitors
- Time-lapse recorders
- Time/date generator
- Vertical jitter

Introduction

This package deals with the CCTV monitor and a few special devices that are related to the monitor. The monitor must receive the video signal and convert it back into a visual image.

The monitor plays a low key role in CCTV systems. However, it can limit the quality of the CCTV system. If the monitor does not have the needed capabilities, it does little good to have an expensive camera. The picture at the monitor is the product of a CCTV system. If the monitor is poor quality, the camera might as well be of poor quality also.

MONITORS

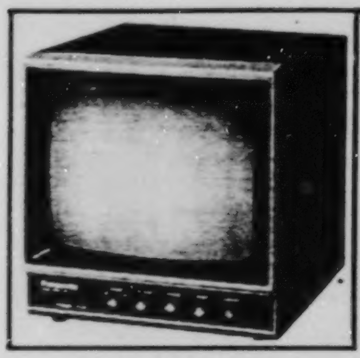
The monitor is the other half of a CCTV system. Some monitors are just black and white TV monitors in an industrial cabinet. Regular TV monitors should not be used in video surveillance systems. They do not have the resolution capacity of the lowest cost CCTV cameras. The monitor, as well as the camera, can limit the quality of the picture.

Monitors are packaged in models that fit the need of security systems. The most popular is the 9" monitor. The 9" monitor can be viewed from 3 to 9 feet and can be used on a desk top. Some are using the 6" model because it requires less space. Distant viewing requires 12, 17 and 19" models.

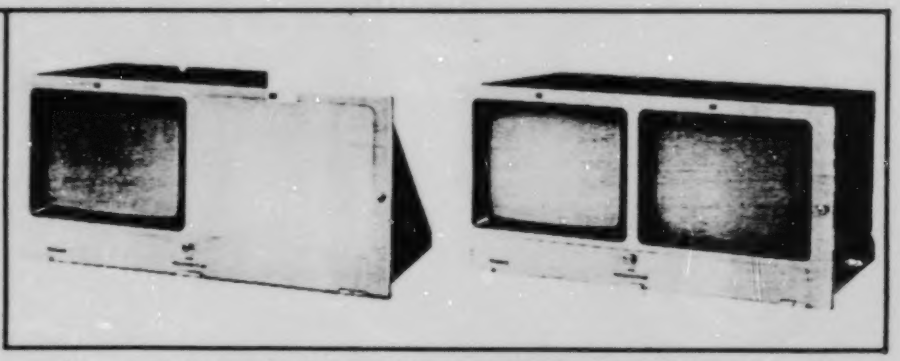
When monitors are used with time-lapse recorders, the monitor must have good horizontal and vertical sync circuits. Time-lapse recorders place heavy demands on the monitor. If they are not designed to handle the recorder, pictures will have vertical jitter or horizontal tearing or both.

Monitors are made for both desk top and rack mounting. They can be stacked in modular units when several screens are to be monitored at a central location.

Some typical monitor units and specifications are shown in the following pictures.



TR-930 9" DESK TOP



TR-931 SINGLE 9" RACK-MOUNT/TR-932 DUAL 9" RACK-MOUNT

PERFORMANCE DATA AND SPECIFICATIONS

Power Source: 120V AC, 60Hz • **Picture Tube:** 9" diag. with 90° deflection, Aluminized Unipotential CRT, Type 230BRB4 • **Video Input:** 1.0Vp-p. High impedance or 75 ohm switchable, BNC-type connector • **Video Frequency Response:** 100kHz: OdB, 13MHz: -6dB • **Horizontal Resolution:** More than 700 Lines (At Center) • **Sweep Linearity:** Better than 7% • **DC Restoration:** 20% • **Ambient Operating Temperature:** 0°C to 40°C (32°F to 105°F) • **Ambient Operating Humidity:** Less than 65% • **Power Consumption:** 23 watts (average) • **Dimensions:** 9" (H) x 8¾" (W) x 9¾" (D) • **Weight:** 11¾ lb. (TR-930), 17¼ lb. (TR-931), 27¾ lb. (TR-932)

Information

TR-195V

TR-195V 19" VTR/CCTV MONITOR

Model TR-195V is a professional quality VTR/CCTV monitor with a 19 inch diagonally measured screen. All components of the TR-195V (except the picture tube) are solid state. The 114° deflection aluminized picture tube displays a sharp, highly detailed image with more than 600 lines horizontal resolution. TR-195V has built-in VHF and UHF tuners and antennas and a 4¾ inch x 3 1/8 inch front-mounted speaker. The UHF tuner now features click-stop tuning that makes 70-channel UHF selection as easy as VHF. TR-195V is suited to any VTR/CCTV system. And with the flip of a front-mounted switch it works independently as a normal television receiver. For complete audio/video input/output versatility, TR-195V features a UHF connector for CCTV and other composite inputs, an 8-pin connector for VTR, video cartridge and cassette recorders, and RCA audio connectors. The monitor is grounded by its three-prong power cord.

PERFORMANCE DATE AND SPECIFICATIONS

Power Source: AC 120V, 60Hz, 79W • **Video Input:** More than 0.5Vp-p. Impedance High Z or 75 ohm switchable UHF type bridging and 8-pin connector • **Video Output:** 1.0Vp-p from TV; UHF type and 8-pin connector • **Horizontal Resolution:** More than 600 lines • **Audio Input:** 8-pin connector, RCA pin jack • **Audio Output:** 8-pin connector, RCA pin jack • **Picture Tube:** 114° deflection aluminized 172 sq. in. viewing area (19" diagonal) • **Tuner:** VHF, UHF click-stop tuner • **Cabinet Finish:** Metal, Black • **Weight:** 45 lbs. • **Dimensions:** 22 3/8" (W) x 16 5/16" (H) x 14 5/8" (D)

Monitors are connected to the coaxial cable with coaxial connectors. The connectors are of UHF or BNC type.

Information

TIME LAPSE RECORDERS

A video tape recorder is often used to provide a record of events at the surveillance site. Recorders are often linked with detection sensors. In alarm conditions, the video recorder is turned on. It can record what is happening in the protected area and can activate other alarm devices such as bells. The recorder has both input and output capacity.

The video tape recorder is helpful in the identification of intruders. It is used in security applications that require good records of voices and actions. Banks and other caretakers of money become targets of criminals. Video tape recorders can help to catch criminals by giving the police an accurate description of those involved.

A video time lapse recorder has a recording memory. It can be programmed to work in several different modes. For instance, the recorder can be placed in a one-shot mode to record single pictures. It can be operated by a timer so that it can record at intervals.

A picture of a video tape recorder and its specifications are shown below.

Information

TIME/DATE GENERATOR

Sometimes an application may require that the time and date be displayed on the monitor. A single time/date generator at the monitor is one way to do it. The character generator is made of CMOS integrated circuits. The displays that are available show month, day, hour, minute, second and tenths of second.

INSERTER/SPLITTER

This device allows the viewer to control the displays on the monitor. The display can be broken into quadrants, inserts or splits by the use of the splitter.

Assignment

- Complete the job sheet.
- Complete the self assessment.
- Complete the post assessment.

Job Sheet

INSPECT A CCTV MONITOR

- Find a monitor that is designed for CCTV systems.
- Inspect the leads to the system.
  - How is monitor connected to coaxial cable?
  - What type of connector is used?
  - Is there a lead for hooking up a splitter or recorder?
- Does it have capabilities for character.generation.

Self Assessment

1. Why should regular TV monitors not be used as CCTV monitors?

2. What size monitor is most popular in the security alarm field?

3. List two basic types of monitors?

4. What is the device called that allows the monitor screen to be divided into quadrants or have inserts added?

5. What does a character generator show?

Self Assessment Answers

1. They do not have as much capacity as TV cameras. Limit quality of picture.

2. 9"

3. Desk top and rack mounted.

4. Inserter/splitter

5. Month, day, hour, minute, second.

Post Assessment

1. What is a character generator or date/time generator?

2. What is an inserter/splitter?

3. What is the purpose of a time-lapse recorder in monitoring CCTV systems?

4. What type of monitor is apt to get "vertical jitter" when a recorder is attached?

5. The ____________________ inch screen monitor is the most popular for security systems.

Instructor Post Assessment Answers

1. The date/time generator shows the date and time of the picture on the monitor screen.

2. An inserter/splitter divides the screen picture into quadrants, adds inserts, etc.

3. A time-lapse recorder can come on with the alarm signal and provide both visual and sound records of the intrusion that caused the signal.

4. A regular TV monitor. It is not of as good quality as the lowest cost CCTV camera.

5. 9"

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA, 90230. (Past issues have good articles on CCTV systems.)

INSTRUCTIONAL LEARNING SYSTEMS

26.5

TIME-LAPSE VIDEO RECORDERS AND VIDEOTAPE

Goal:

The apprentice will be able to describe time-lapse video recorders and their applications in bank surveillance systems.

Performance Indicators:

1. Describe time-lapse video recorders.
2. Describe video tape.
3. Describe applications of time-lapse recorders in bank security.

Study Guide

- Read the goal and performance indicators to find out what you are supposed to learn from the package.
- Read the vocabulary list to become acquainted with the trade terms to be used.
- Study the introduction and information sheets.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Vocabulary

- Reel-to-reel tape
- Time-laps video recorder
- Videocassette

Introduction

The time-lapse video tape recorder has become the backbone of video surveillance in banks. Video tape recorders are being used in the supervision of tellers, training of tellers and for security. In case of robbery, the bank has instant identification of the robbers. They do not need to wait for film to be processed.

Many banks are using still photography to make picture records for security purposes. There seems to be a trend away from still cameras in new systems. This package will emphasize the time-lapse video recorder as a device for bank surveillance.

Information

VIDEO RECORDERS

TIME-LAPSE VIDEO RECORDERS

The time-lapse video recorder offers many advantages in bank security systems. The recorder can be programmed to function when an alarm is triggered. For example, a bank teller might use a foot rail to give an alarm during a bank holdup. The alarm signal would turn on the time-lapse video recorder at the same time. A complete picture record of the robbers actions would be available to police in a very short time.

Banks use the time-lapse video recorder for other purposes. These devices are excellent for training and supervising bank tellers. The recorder can be set to tape short scenes at intervals. For instance, the recorder can be set to record single pictures every five minutes of the day. A bank supervisor could review a teller's activities for a working day in just a few minutes. As you can see, the time-lapse recorder is an excellent training device.

A picture of a Panasonic time-lapse video recorder is shown below. A description of the recorder and its special features are included.

NV-8030

NV-8030 TIME LAPSE VTR

The Panasonic NV-8030 time lapse video tape recorder is especially designed for closed circuit security applications. Its true time lapse system recrods 9, 18, 72 or 108 hours of black-and-white pictures on a single 7" reel (2400 ft.) of ½" video tape. The VTR can also operate at the normal 7½ i.p.s. speed, in accordance with the EIAJ #1 black-and-white standard. Tapes recorded in the normal mode are thus fully compatible with other EIAJ #1 black-and-white standard VTR's.

SPECIAL FEATURES

Provides a continuous record of events lasting up to 108 hours • Versatile system application • Front panel time select pushbutton for 1H (normal), 9H, 18H, 72H, 108H and 1 SHOT modes • In 1H (normal) mode, tapes are recorded in accordance with the EIAJ #1 black-and-white standard and are fully compatible with other EIAJ standard VTR's • True time lapse system records 9, 18, 72 or 108 hours on a single 7" reel (2400 ft.) of video tape • 1 SHOT mode records single pictures, one at a time. When used with a timer to provide momentary contact closure at specified interval, maximum recording time can be greatly extended to 30 days, 5 months or 1 year or more • Complete stop action playback capability in 1 SHOT mode: the VTR plays back a single picture (one field) when the 1 FIELD button is pressed. To obtain a perfect still frame picture, the ½ FIELD button may be used to eliminate any noise on the screen • Alarm mode permits return to normal (1H) or 9H record mode when the alarm input is activated • Activation of alarm mode by alarm sensor (door switch, etc.) • Alarm output (6V DC, 120 ohms) can be used to activate external devices (warning lights, buzzers, etc.) • Unique alarm memory system permits rapid search of tape to find portions that have been recorded in alarm mode • No disturbance of horizontal picture lines when the tape is recorded at low speed and played back at any higher speed • Audio record/playback capability in 1H, 9H and 18H modes • Designed for high reliability, with three motor tape drive system, specially designed die cast chassis, ball bearings, and HPF™ video heads • Maintenance timer shows elapsed operating time • Trigger output for use with sequential switchers • Sequential operation of up to three NV-8030's by cascade connection: when the end of tape is reached on one VTR, the next VTR is started automatically • Automatic gain controls for video and audio levels, manual control with illuminated level meters • V-pulse (switchable) can be added to video output during playback when needed for better stability • Horizontal resolution 300 lines at center in normal (1H) mode • Digital tape counter.

Information

A time-lapse recorder may capture a single frame of action out of each second or minute of the day. This is called the interval between each recording. The recorder may be set for any length of interval. A reel of tape will last according to the interval setting of the recorder.

The video recorder can be used with standard CCTV surveillance cameras. The video tape can be either reel-to-reel tape or of videocassette type.

APPLICATIONS OF RECORDERS

The recorder can be used to record at timed intervals to summarize an entire day in a few minutes of playback. Or the recorder can only come on when the system alarms. It may be programmed to function by both methods. The recorder can record at timed intervals throughout the day. When an alarm triggers, the recorder will break into an alarm mode and will record continuously during the alarm period.

The video tape recorder can provide accurate descriptions of robbers in a matter of seconds. A memory allows the recorder to play back alarm modes immediately. The picture can be stopped at a single frame for viewing of suspects.

VIDEO TAPE

Tape is bought as:

- Videocassette
- Reel to reel tape

The standard sizes of video tape are:

- 1/2"
- 3/4"

Playing time is based on 1/2 hour increments:

30-60-90-120-150-180-210-240 and 270 minutes

Tape should be selected for the signal-to-noise ratio and the sharpness of the picture. There are many brands of tape of varying quality. The installer should be aware of these quality factors when recommending tape for video recorders.

Information

In time-lapse recording, a single 7" reel (2,400 feet) will record up to 108 hours. The length of time will depend on the intervals at which the camera operates. Through the use of a timer to provide momentary contact closure at specified intervals, the recording time can be increased to six months for a single reel.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

EXAMINE A TIME LAPSE RECORDER

- Locate a store or supply house that has a time-lapse recorder for sale.
- Ask the salesman to explain the features of the recorder.
- Examine the recorders adjustments and connections.
  - Where does camera hook up?
  - How is the time-lapse interval set?
  - Is there an input for hooking recorder to alarm devices?
  - Does the recorder have an output connection? What is its purpose?
  - What other special controls are found on the recorder?

Self Assessment

1. What uses, other than security, might be made of a time-lapse video recorder?

2. What is meant by time-lapse?

3. List two types of video tape?

4. What are the standard sizes of video tape?

5. Video tape should have a good _______________ ratio.

Self Assessment Answers

1. Training and supervising tellers.

2. The recorder is turned on at intervals for just a moment. When played back, a full day can be viewed in a few minutes.

3. Reel to reel and videocassette.

4. 1/2" and 3/4"

5. Signal to noise ratio.

• Post Assessment

1. List two standard sizes of video tape.

2. List two types of video tape.

3. What other purposes could a time laps recorder serve in a bank? Other than security.

4. What kind of camera is needed with a video tape recorder?

5. Under a normal time-lapse system, a 2400 ft. reel of tape will cover up to _________ hours of recording.

Instructor
Post Assessment Answers

1. 1/2" and 3/4"

2. Reel to reel and videocassette

3. Training and supervising tellers.

4. A standard surveillance camera

5. 108 hours

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. 90230. (Past issues.)

INSTRUCTIONAL LEARNING SYSTEMS

26.6

CCTV CAMERA LENS

Goal:

The apprentice will be able to describe closed-circuit television camera lens and their applications.

Performance Indicators:

1. Describe lens speed and f numbers.
2. Describe focal length.
3. Describe fixed focal length and zoom lenses.
4. Determine focal length and field of view.

Study Guide

- Read the goal and performance indicators. Find out what you are expected to learn from this package.
- Read the vocabulary list. Get acquainted with the trade terms in the package.
- Read the introduction and information sheets for technical information.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

Vocabulary

- Adjustable iris
- Automatic iris
- Depth of field
- Field of view
- f number
- Focal length
- Lens speed
- Manual iris
- Zoom lens

Introduction

All cameras must use a lens to focus an image on the image tube. An understanding of lens selection is very important to the installer of video surveillance systems.

Although lens selection sounds very complex, there are only a few basic characteristics that are critical to making a good selection. This package is designed about these characteristics of lenses.

Information

LENS SPEED AND f NUMBER

Lens speed in TV cameras relates to the amount of light collected and passed by the lens. A fast lens means more light on the image tubes and that the lens can operate at lower light levels. Slow lens means less light and higher levels of light needed for operation.

Lens speed is rated by an f number. The smaller the f number, the faster the lens. An f 1.4 lens is faster than a 2.8 lens. Most lens have an adjustable iris which allows the lens opening to be changed. Markings on the iris adjustment show the f numbers for each lens stop. These numbers will fall in a series (f 1.4, f 2.0, f 2.8, f 4.0, f 5.6, f 11, f 16, f 22. As the iris is adjusted to a higher f reading, it gives one-half the speed in light transmission as the f number before it. The f 4.0 stop is one-half as fast as f 2.8.

CCTV lens are most often used in a wide open position. This means the camera is set at the smallest f number. Many surveillance cameras do not have an adjustable iris. There may be times when it is desirable to use a higher f number. If light conditions are good, the higher f number will produce a clearer image at the higher f number.

A lens possesses greater depth of field at the higher f numbers. Depth of field is the range at which scene objects appear to be in focus. In other words, depth of field means that range in which picture objects look clear--not fuzzy.

FOCAL LENGTH

The second important feature of a lens is its focal length. This refers to the viewing angle of the lens. A 25 mm lens will cover a 25 foot wide scene at 50 feet. The focal length determines the field of view of the lens. The focal length is expressed in mm (millimeters). Lens have size ratings of 8.5, 11.5, 25 and 50 mm.

If we know the field of view, the focal length can be calculated. The formula for focal length (F) is:

$$F = \frac{8.8\,L}{W}$$

L = distance between camera and object
W = width of object

As an example, we wish to buy a lens that covers a 20 foot wide area. The area to be covered is 30 feet from the camera.

$$F = \frac{8.8 \times 30}{20} \qquad F = 13.2 \text{ mm}$$

Information

If we know the focal length of our lens and width of object and want to know how far the camera should be placed from the object, it can be easily calculated. For example, we have a 12.5 mm lens and an object that is 20 feet wide.

$$F = \frac{8.8\ L}{W}$$

$$12.5 = \frac{8.8\ L}{20}$$

$$8.8\ L = 250$$

$$L = 28 \text{ feet}$$

The camera would be mounted 28 feet from the scene.

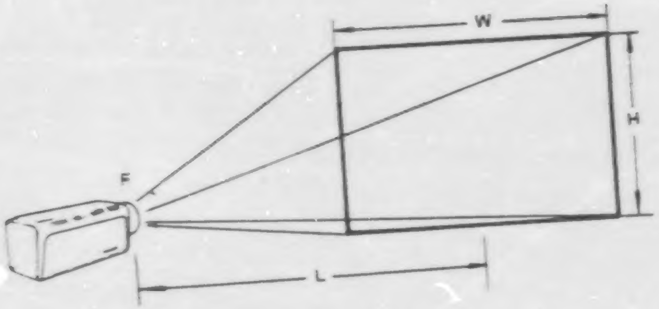
The following diagram shows how to calculate focal length and field of view.

To determine focal length of lens:

$$F = \frac{8.8L}{W} \qquad F = \frac{6.6L}{H}$$

To determine field of view:

$$W = \frac{8.8L}{F} \qquad H = \frac{6.6L}{F}$$



W: Width of object (in Feet)
H: Height of object (in Feet)
L: Distance between camera and object (in Feet)
F: Required focal length (in mm)

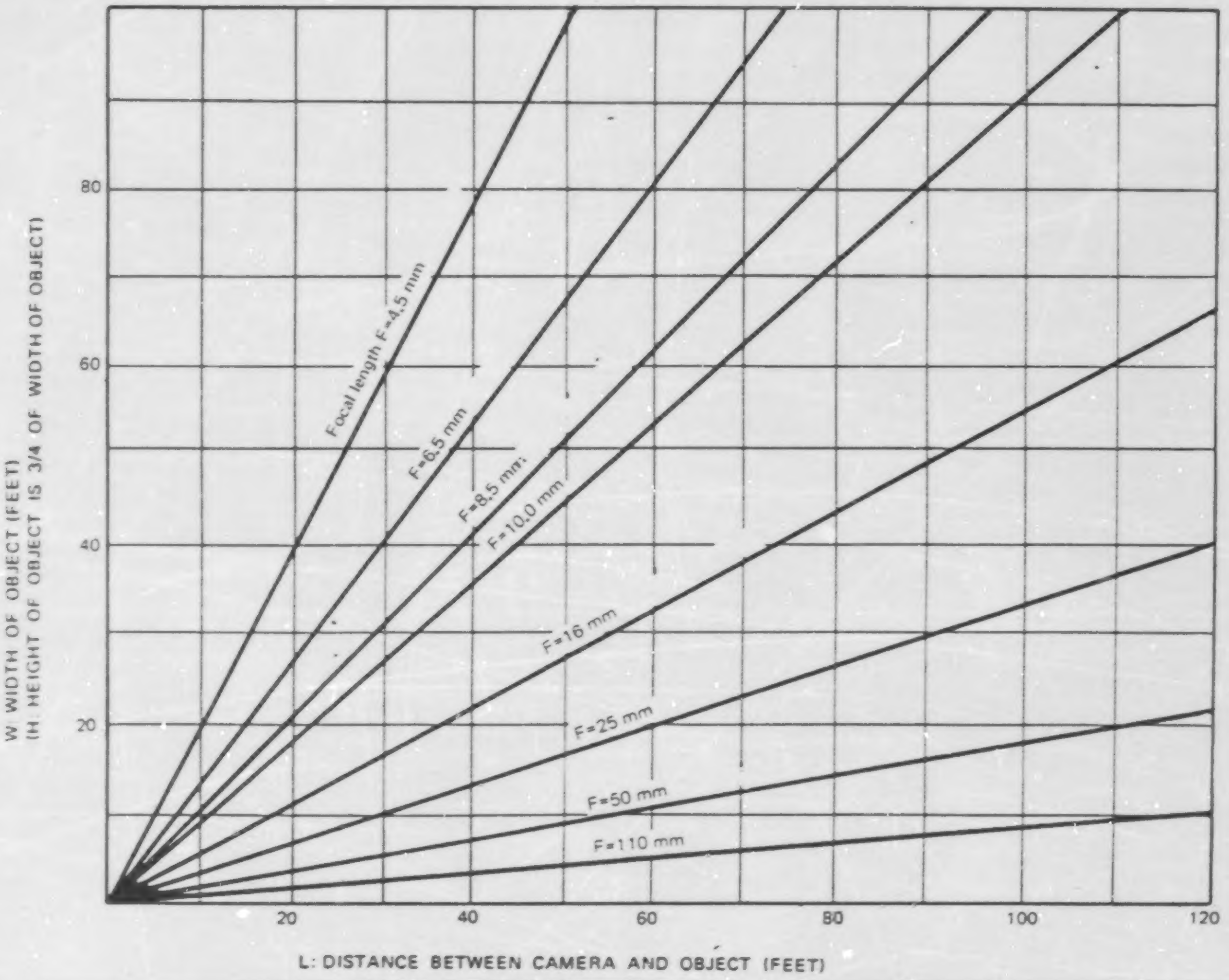
Information

A selection guide for buying lens is shown in the following chart. The chart can be used to determine both focal length and field of view.

CCTV LENS SELECTION GUIDE

FOCAL LENGTH AND FIELD OF VIEW

The required lens can be selected from the following graph depending on the distance between camera and object and required field of view.



Information

TYPES OF LENS

CCTV lens are of two basic types:

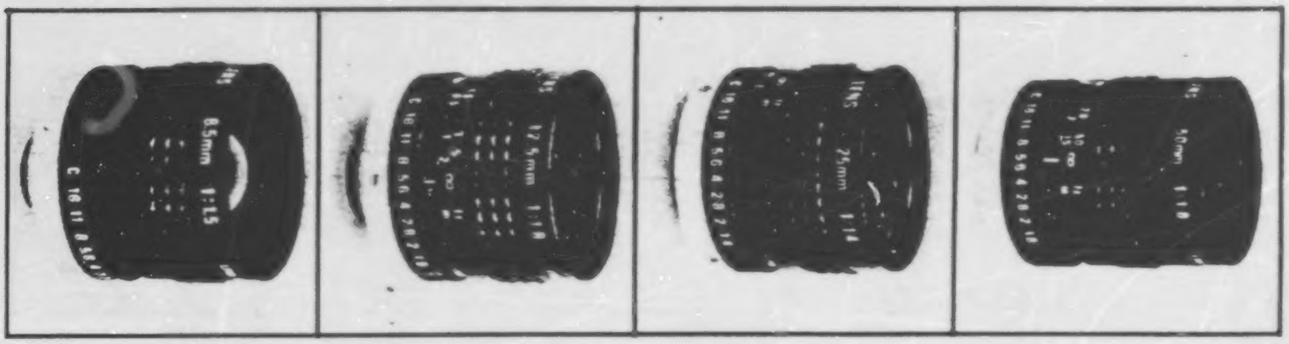
- Fixed focal length
- Zoom lens with adjustable focal length

The fixed focus length lens can only handle their one field of view. A zoom lens can be adjusted to different fields of view. Although more expensive, the zoom lens can be used in a wide range of applications.

Lenses are also classified as:

1. Manual iris lens
2. Automatic lens

In the manual iris type, the operator can make adjustments in the amount of light that enters the iris. An automatic iris is controlled by the camera. Pictures of manual iris, auto iris and zoom lenses are shown below.



CAMERA TUBE DIAMETER

The image tube (vidicon) of a CCTV camera is either a 2/3" or a 1" tube. When buying lenses, it is important that the lens fit with the image tube.

Information

APPLICATIONS

Most applications use fixed focal length lenses that are appropriate to the field of view. Zoom lenses are used in special applications that need more than a single field of view. Sometimes zoom lenses are used in remote locations and the zoom is controlled by dialers.

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check your answers.

INSTRUCTIONAL LEARNING SYSTEMS

Job Sheet

CALCULATE FOCAL LENGTH OF LENS FOR A PROJECT

- Find a nearby lobby that lends itself to video surveillance.
- Measure the field of view needed for good coverage.
- Identify where the camera needs to be mounted and measure the distance from camera to the objects to be pictured.
- Using the formula $F = \frac{8.8\ L}{W}$, calculate focal length of lens for the job.

•Self Assessment

1. Which is a faster lens--an f 1.4 or an f 2.8?

2. Is an f 4.0 lens twice as fast or half as fast as an f 2.8 lens?

3. Do all CCTV cameras have an adjustable iris?

4. A lens possesses greater depth of field at the ________________________ (higher, lower) f numbers.

5. Focal length is expressed in ________________.

6. What determines the size of the field of view?

7. Which type of lens has an adjustable focal length?

8. A man wishes to set up a TV camera 30' from a shopping area. He wishes to cover a field of view that is 28' X 24'. What focal length lens should he use in the camera?

9. Another man has a 25 mm lens and wishes to mount it on a wall some 25' away from the objects to be viewed. How wide an area will the man be able to picture?

10. A company wishes to set up a camera in a remote site and have it give surveillance to several fields of view? Which lens should be used?

Self Assessment Answers

1. 1.4
2. Half as fast
3. No
4. Higher
5. mm
6. Focal length
7. Zoom
8. 1.1 mm
9. 8.8 feet
10. Zoom (adjustable)

INSTRUCTIONAL LEARNING SYSTEMS

Post Assessment

1. Is an f 1.4 lens as fast as an f 2.8?

2. As the lens iris is adjusted to the next higher stop, the lens speed is

   ____________________.
   (increased, decreased)

3. What does 50 mm mean when talking about a lens?

4. What is meant by an adjustable iris?

5. A field of view for a camera is determined by the ________ ______________ of the lens.

6. What is a zoom lens?

7. The range in which objects appear to be in focus is called __________ __________ ______________.

CALCULATE THE FOCAL LENGTH OF THE FOLLOWING FIELDS OF VIEW:

	Width of FOV	Distance from camera to object
8.	12'	10'
9.	18'	30'
10.	28'	50'

Instructor
Post Assessment Answers

1. Yes -- twice as fast

2. Decreased

3. Focal length of lens

4. It means that the f numbers can be changed by adjusting the iris in the lens.

5. Focal length

6. A lens with adjustable focal length.

7. Depth of field

8. 7.3 mm

9. 14.6 mm

10. 15.7 mm

Supplementary References

- Security, Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. (Several past issues have CCTV articles).

INSTRUCTIONAL LEARNING SYSTEMS

26.7

CCTV COMPUTER INTERFACE CONTROL

Goal:	**Performance Indicators:**
The apprentice will be able to describe computer interface control for CCTV systems.	1. Describe interface control. 2. Describe operations that can be controlled by computer.

Study Guide

- Read the goal and performance indicators for this package.
- Read the vocabulary list. Note trade terms to be introduced in this package.
- Study the introduction and information sheets.
- Complete the job sheets.
- Complete the self-assessment and check answers.
- Complete the post-assessment and have the instructor check your answers.

Vocabulary

- Interface control
- Pan/tilt control
- Scanner control
- Switching network
- Zoom lens control

Introduction

Security alarm systems become more complex with each passing year. Detection devices represent a whole range of technology from simple trip wires to ultrasonic detectors. The transmission of signals through multiplexing and digital communicators have added to the complexity of alarm systems.

Closed circuit television surveillance is being widely used to control the human tide in banks, stores and industry. CCTV systems have become more complex with switchers, image splitting and time-lapse techniques.

Large firms are being pushed toward the use of computers to manage their security systems. CCTV is only one of many security features that can be managed by a computer. The computer can manage the CCTV system along with the heat, lights, air conditioning and other detection devices.

Information

Switching Network

Several video cameras can be served by one monitor through a single coaxial cable. A switcher allows the cameras to appear on the monitor in a sequence. The switching network can be interfaced with a computer.

A protected area is usually covered by other types of sensors along with CCTV. If an alarm occurs at one of the sensors, the transponder will report the alarm to the computer. The computer can identify the camera that is located in the alarm area. That camera is switched to a television monitor at the central station. A computer cannot transmit video signals but it can control when and where it is transmitted.

Zoom Lens Control

A zoom lens is a device that will change the focal length of a camera. The motorized zoom lens allows focal length to be changed automatically. The motorized zoom lens can be operated by computer instructions.

Pan/Tilt Control

The pan/tilt device does not change the focal length. It does move the camera horizontally and vertically to increase the fields of view. This device is also motorized. Pan/tilt control can be controlled by computer.

Scanner Control

A CCTV scanner can also be managed by a computer. The scan cycle is programmed on the computer. Through an interface control, the motorized scanner will operate according to its instructions.

Interface Control

The computer cannot transmit video signals. This must be done by coaxial cable between the camera and the monitor. The computer can control the switches which determines the sequence of displays of several cameras. In other words, the computer cannot control what comes out of a CCTV system. It can control the order in which the information is displayed. It can coordinate CCTV surveillance with other detection devices. The switcher and the computer must be interfaced to allow instructions to be transmitted to the switches. The computer must also be interfaced with the camera controls when used to control pan/tilt, scan and zoom functions.

Through interface controls, the computer can be used to manage security alarm systems that are too complex for humans to handle.

Assignment

- Complete the job sheet.
- Complete the self-assessment and check answers.
- Complete the post-assessment and have instructor check your answers.

Job Sheet

VISIT COMPUTER MANAGED SYSTEM THAT INCLUDES CCTV SYSTEM.

- Find a local computer-managed system that includes CCTV.
- Ask the operator to explain how the system works.
- Identify:
  - How many cameras are managed by computer.
  - How CCTV monitors are located.
  - Which functions of CCTV system are controlled by computer.
  - Which functions of CCTV are independent of computer.
  - What types of interface equipment are required.

Self Assessment

1. How can computers and switchers be interfaced?

2. A zoom lens changes ______________ ______________ of a camera.

3. How can computers and zoom lens be interfaced?

4. A ________________ controls the order or sequence in which several cameras display their video information.

5. A pan/tilt control moves the camera vertically and horizontally to increase the __________________ of __________________ for that camera.

Self Assessment Answers

1. The computer can control the switcher to display video information form several coameras in a programmed sequence. The computer can identify cameras in areas where an alarm is triggered and pull that camera's view onto a monitor in the central station.

2. Focal length.

3. A motorized zoom lens can be managed by computer instructions. It requires an interface between computer and zoom control.

4. Switcher

5. Field of view

Post Assessment

1. List three CCTV fucntions that can be managed by a computer.

2. A ______________ lens is used to change the focal length of a camera during operation.

3. A _______________ is used to sequence displays on a CCTV monitor.

4. A ________________ control changes the field of view of a camera during its operation.

5. Computers can manage other types of devices through ____________ control with those devices.

Instructor Post Assessment Answers

1. Switchers, pan/tilt and zoom
2. Zoom
3. Switcher
4. Pan/tilt
5. Interface

Supplementary References

- Barnard, Robert L. Intrusion Detection Systems: Principles of Operation and Applications. Butterworth Publishers, Boston. 1981.

INSTRUCTIONAL LEARNING SYSTEMS

26.8

VIDEO TRANSMISSION

Goal:

The apprentice will be able to describe how video transmission takes place.

Performance Indicators:

1. Describe transmitters.
2. Describe picture signals.
3. Describe sound signals.
4. Describe receivers.

Study Guide

* Read the goal and performance indicators for this package.
* Read the vocabulary list for this package.
* Study the introduction and information sheets.
* Complete the job sheet.
* Complete the self assessment and check answers.
* Complete the post assessment and have your instructor check the answers.

Vocabulary

* Amplitude modulation
* Audio amplifier
* Cathode ray tube
* Frequency modulation
* High frequency radio signal
* Loudspeaker
* Picture signal
* Scanning beam
* Sound signal
* Sound signal amplifier
* Transmitter
* Video amplifier
* Video receiver

Introduction

Video transmission can be performed through coaxial cable. The cost of cable installations limit the distance between transmitter and receiver. If CCTV is to be used over long distances, the system must operate as a regular TV station.

Video signals involve both picture and sound signal transmission. Each type of signal requires its own transmitter and antenna. The signal is transmitted through the air by high frequency radio waves. A receiver and antenna must be available to pick the signals out of the air and convert them into sound and pictures.

Amplification of both sound and picture signals are required at the transmitter and at the receiver. This increases the strength of the signals.

Information

Two transmitters are required for transmission of video signals. One transmitter sends out picture signals and the other sends sound signals. Both transmitters send out high frequency radio signals. Flow charts of the two transmitters are shown below.

Picture Signal

A whole picture cannot be transmitted. It is broken into many tiny parts of light. A scanning beam in the video camera sweeps across a picture and breaks it into 525 lines at the rate of 30 pictures per second. The scanning beam is a beam of electrons. After the picture is broken into electrons, the singlas are made stronger by a video amplifier. At the transmitter the signals are combined with the high-frequency carrier wave of the transmitter and sent out through the antenna. The video signals travel in a straight line like a beam of light. Signals are picked up by the antenna of the television receiver.

Sound Signal

Sound waves and carrier waves are combined at the transmitter. Amplitude modulation increases or decreases the strength of the carrier waves by being combined with the sound waves. Another method of combining sound and carrier waves is frequency modulation. In frequency modulation the sound waves vary the frequency of the carrier. Sound signals are amplified by an audio amplifier before reaching the transmitter.

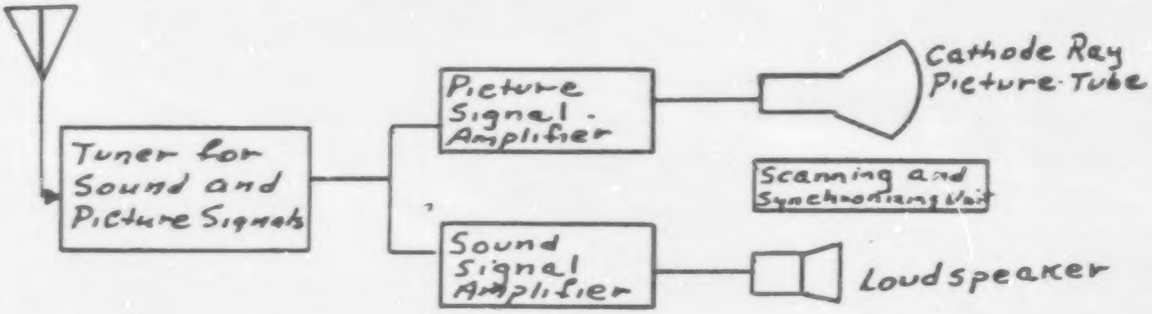
Video Receiver

A video receiver has a tuner that allows selection of channels. It contains a picture signal amplifier and a sound signal amplifier to increase the strength

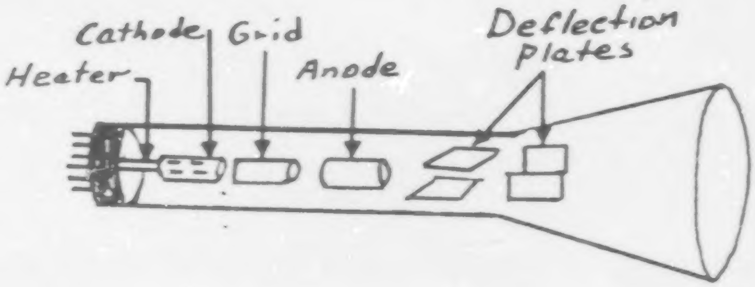
Information

of the signals. A loudspeaker unit allows the sound signal to be heard. The picture signal is viewed on a cathode ray picture tube. A television screen is the face of a cathode ray tube. A beam in the cathode ray tube travels across the face of the tube to make 525 lines at 30 times per second. It works at the same speed as the scanning beam of the camera. An electron beam is travelling across the screen 15,750 times per second. This beam paints the same picture that the camera picks up.

A flow diagram of a video receiver is shown below.


Picture Signal Amplifier
Cathode Ray Picture Tube
Tuner for Sound and Picture Signals
Scanning and Synchronizing Unit
Sound Signal Amplifier
Loudspeaker

A cathode ray picture tube is shown below.


Cathode
Grid
Deflection Plates
Heater
Anode

Remote Systems

Video signal transmission finds applications in remote stations where visual surveillance of an area is needed and it is not profitable to man the station. CCTV cameras are installed at the remote sites and transmitted to a distant

Information

location for monitoring. Some Alaskan utility companies use video systems in their substations in remote locations. When a problem is spotted, a supervisor will fly out to the location and resolve the problem. Oil well security is another example.

Assignment

- Complete the job sheet.
- Complete the self assessment.
- Complete the post assessment.

Job Sheet

STUDY THE SPECIFICATIONS OF VIDEO TRANSMITTERS AND RECEIVERS

- Obtain a catalog of video surveillance equipment.
- Read specifications that relate to signal transmission.
- Read specifications of amplifiers.
- List specific items needed to transmit picture and sound signals between protected area and monitoring station.

Self Assessment

Match the following terms with the phrases that best describe their function.

____	1.	Scanning beam	A.	Strengthens the picture signal.
____	2.	High frequency radio signals	B.	Strengthens the sound signal.
____	3.	Audio amplifier	C.	Increases or decreases the strength of the carrier waves.
____	4.	Video amplifier	D.	Used to carry video through the air.
____	5.	Amplitude modulation	E.	Breaks a picture into 525 lines of light electrons.
____	6.	Loudspeaker	F.	Vary the frequency of carrier waves.
____	7.	Cathode ray tube	G.	Travels across screen 15,750 times per second.
____	8.	Cathode ray tube beam	H.	Allows channel selections to be made.
____	9.	Tuner	I.	The part that we view the picture on.
____	10.	Frequency modulation	J.	The part which delivers sound to viewers.

Self Assessment Answers

E 1.

D 2.

B 3.

A 4.

C 5.

J 6.

I 7.

G 8.

H 9.

F 10.

Post Assessment

1. Video signals are transmitted by high frequency ______________ signals.

2. A ________________ beam divides a picture into 525 lines of light signals.

3. An __________________ amplifier is used to strengthen sound signal.

4. A ____________________ amplifier is used to strengthen the picture signal.

5. ____________________ modulation vary the frequency of the carrier wave.

6. A ____________________ ray picture tube is used to view a picture signal.

7. The sound signal is heard through a __________________ at the receiver end of video transmission.

8. A ____________________ allows a receiver to pick up different channels of transmission.

9. If both sound and picture signals are to be transmitted, ______________ transmitters will be needed.

10. Video signals leave the transmitter through the _________________ and enter the air.

Instructor Post Assessment Answers

1. Radio
2. Scanning
3. Audio
4. Video
5. Frequency
6. Cathode
7. Loudspeaker
8. Tuner
9. Two
10. Antenna

Supplementary References

- Supply catalogs for CCTV equipment.

INSTRUCTIONAL LEARNING SYSTEMS

26.9

CCTV ENCLOSURES

Goal:

The apprentice will be able to describe camera enclosures and their applications.

Performance Indicators:

1. Describe environmental enclosures.
2. Describe dust-proof enclosures.
3. Describe ceiling enclosures.
4. Describe theft proof enclosures.
5. Describe indoor housings.
6. Describe applications of housings and enclosures.

Study Guide

- Read goal and performance indicators for package.
- Read vocabulary list.
- Read introduction and information sheets.
- Complete the job sheet.
- Complete self-assessment and check answers.
- Complete post assessment and have instructor check answers.

Vocabulary

- Air inlet port
- Ceiling enclosures
- Dustproof enclosures
- Environmental enclosures
- Indoor housing
- Outlet port
- Theftproof enclosures

Introduction

CCTV cameras must be given some protection if they are to function over a period of time. Outdoor camera locations have environmental considerations such as rain, fog and dust. Also, the camera may need protection from vandalism. Indoor cameras need to be placed in housings or enclosures that are attractive and to avoid attention. Dustproof housings are also important for indoor cameras.

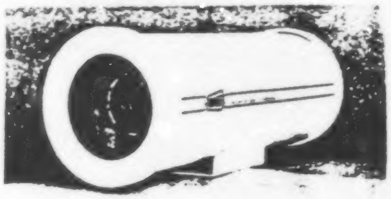
This package will deal with several types of enclosures and housings for CCTV cameras. Enclosures and housings are designed to protect the camera against human and environmental problems. The installer must be able to select enclosures that are appropriate to each location.

Information

ENVIRONMENTAL ENCLOSURES

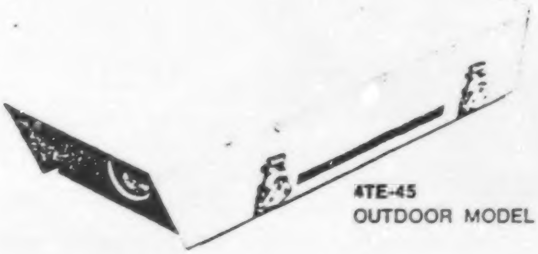
Environmental enclosures are made of aluminum with weatherproof, heat reflecting paint. These enclosures have removable sides that allow the installer to work on the camera. A rear air inlet port allows a flow of air from rear to front. The air flow draws heat away from the camera and prevents fogging of the lens. Environmental enclosures can be purchased with a thermostat, heater and a blower system. In these enclosures, the blower outlet port allows air to move across the lens to prevent fogging-up.

An environmental enclosure is pictured below:



THEFTPROOF ENCLOSURES

In some applications, the camera must be protected against theft. Theftproof enclosures have locking doors. They are made from steel and have electrical knock-outs for running cable into the enclosure.

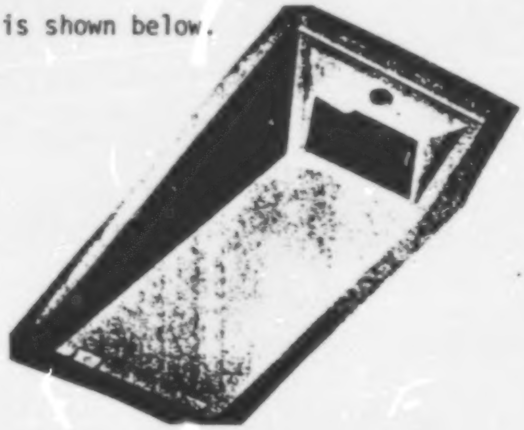


Information

CEILING ENCLOSURES

Ceiling enclosures are mounted into the ceiling. The enclosure has a hinged, lockable bottom that allows installers to access the camera. These enclosures have a sturdy steel housing. The camera and lens adjustments can be made from below the camera. The visible portions of ceiling enclosures are finished in white vinyl paint. Models are available for any type of ceiling.

A typical ceiling enclosure is shown below.



DUSTPROOF ENCLOSURES

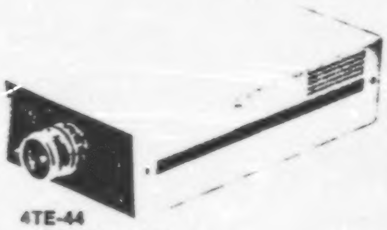
Many applications require the camera to be shielded from dust. A dustproof enclosure is also moisturepro0f. It can protect the camera in wet conditions as well as dusty conditions. The enclosure is built as a seamless tube that can be accessed from both ends. The enclosure can be purchased in 8" and 10" diameters. Cables are fed into a dustproof enclosure through a sealable port. A sunshield is available for these enclosures.

A dustproof enclosure is shown in the following picture.

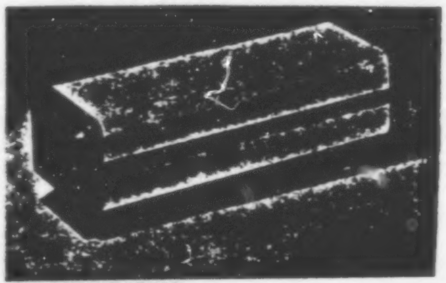
Information

INDOOR HOUSINGS

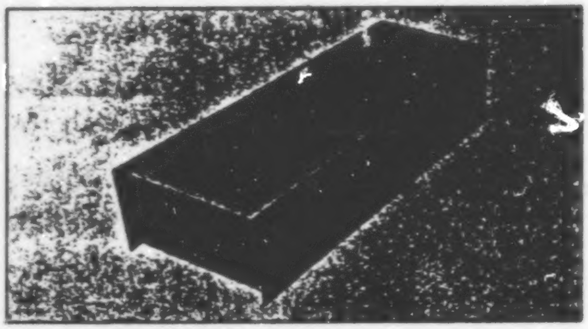
Indoor cameras are housed in enclosures that are attractive and tamperproof. There are many styles of housings. Most have locked sides to prevent tampering. A typical indoor housing is shown in the picture below.



4TE-44
INDOOR MODEL



INDOOR HOUSING



INDOOR HOUSING

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have the instructor check your answers.

Job Sheet

- Visit the storeroom where you work or a supply house that sells CCTV equipment?
- Inspect the different types of enclosures on display and read manufacturer's information on each type.
- Identify characteristics of each type of enclosure.
  - Dustproof
  - Environmental
  - Theftproof
  - Ceiling
  - Indoor housings
- Will you be able to identify them by their purpose the next time you see them?

Self Assessment

1. Most environmental enclosures are made of ____________________.

2. Most theftproof enclosures are made of ______________________________.

3. Ceiling enclosures are built to allow the camera to be adjusted from ______________________ the enclosure.

4. ____________________ enclosures are built as a seamless tube.

5. Indoor housings should be attractive and also protect against ______________.

Self Assessment Answers

1. Aluminum

2. Steel

3. Below

4. Dustproof

5. Tampering

Post Assessment

1. What type of material is used in theftproof enclosures?

2. What type of material is used in environmental enclosures?

3. Which type of enclosure is built as a seamless tube?

4. List two features that are needed in indoor housings?

5. Must cameras be removed from ceiling enclosures in order to make adjustments on them? Explain your answer.

Instructor
Post Assessment Answers

1. Steel
2. Aluminum
3. Dustproof
4. Attractive and tamper proof.
5. No. They have a hinged access on the bottom. The camera adjustments can be made from below.

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. 90230. (Past issues have very good articles on CCTV systems and new products.)

INSTRUCTIONAL LEARNING SYSTEMS

26.10

CCTV CONTROL EQUIPMENT

Goal:

The apprentice will be able to describe CCTV control equipment and its applications.

Performance Indicators:

1. Describe pan, tilt and scan controls.
2. Describe image splitter controls.
3. Describe switchers.
4. Describe zoom lens controls.
5. Describe use of video amplifiers.
6. Describe applications of a time/date character generator.

Study Guide

- Read the goal and performance indicators to find what should be learned from this package.
- Read the vocabulary list to learn trade terms to be introduced in this package.
- Study the introduction and information sheets for technical information.
- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructor check answers.

Vocabulary

- Alarm type sequential switcher
- Auto homing sequential switcher
- Bridging sequential switcher
- Homing sequential switcher
- Image splitters
- Image splitting optics
- Looping input sequential switcher
- Motorized zoom lenses
- Pan and tilt control
- Remote sequential switcher
- Scanner control
- Sequential switcher
- Sequence
- Switcher
- Time/date character generator
- Video amplifier
- Zoom lens

Introduction

Cameras and monitors are the working units of a CCTV system. In order to get the cameras and monitors to work properly, control units must be added to the system.

Control units help the camera and monitor to do a better job of surveillance and display. The installer must know about controls and how each type should fit into the CCTV system.

Information

Control equipment makes the CCTV system function when needed and in an orderly way. Some of the common control equipment includes:

- Image splitters
- Switchers
- Scanner controls
- Pan and tilt controls
- Zoom lens controls
- Video amplifiers
- Time/date character generator

Some applications require more than one camera scene to be displayed on a single monitor. Such applications are possible by:

- Using two cameras, two coaxial cables and two monitors. One electronic switchers and one monitor may be used in place of the two monitors.
- Using two cameras, two coaxial cables, one monitor and an electronic splitter.
- Using one camera, one coaxial cable, one monitor and one optical splitter.

One application for use with one camera is called image splitting optics. A small optical splitter is screwed into the "C" mount of the camera. Two lenses are then screwed into the optical splitter. This splits the scene into two scenes--½ and ½. The splitting may be done vertically or horizontally.

The splitter is a lens that views a side scene while the main lens is viewing the scene in front of the camera.

Electronic splitters can handle several cameras at one time. They can be programmed to show several scenes on one monitor screen at a given time. The screen can be divided into quadrants or other desired segments for viewing.

SWITCHERS

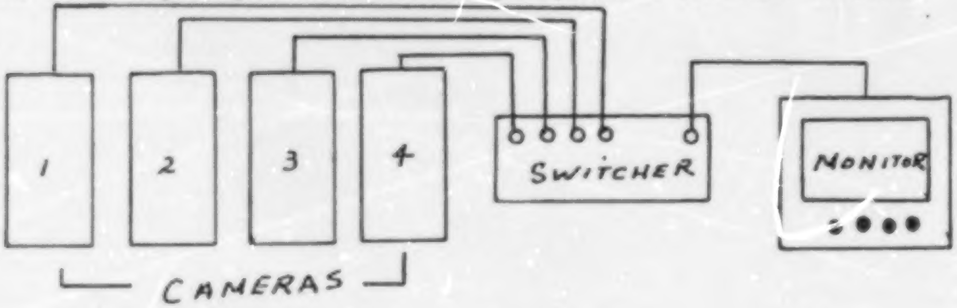
Switches are devices used to monitor several cameras on a single screen. The switcher can show a short sequence of one camera's field of view and then move to another

Information

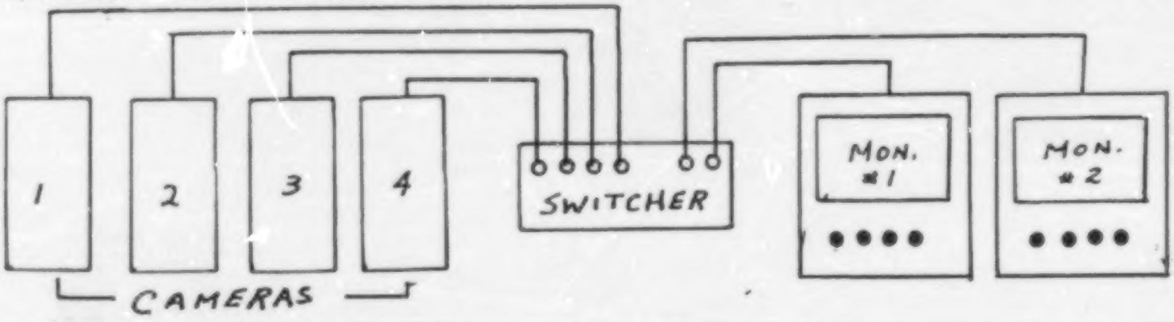
camera. Each camera's field of view is shown for a few seconds in rotation. Since the device follows an orderly sequence, they are called sequential switchers. The switchers may be wired to function in a variety of ways. They have been classified according to their electrical function.

- Homing sequential switcher
- Auto homing sequential switcher
- Looping input homing sequential switcher
- Looping input bridging sequential switcher
- Bridging sequential switcher
- Remote sequential switcher

The following diagram shows a homing sequential switcher circuit.



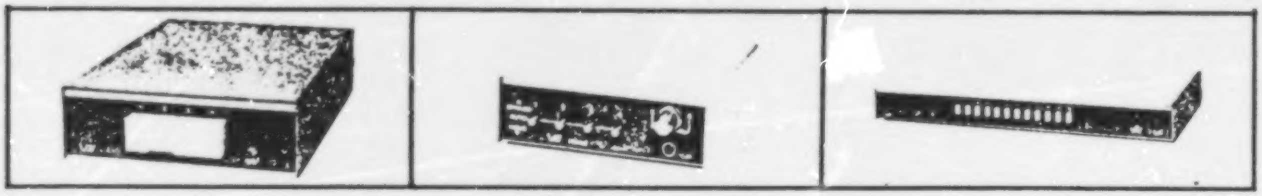
A bridging sequential circuit switches between several cameras and two monitors. For example, bridging circuits allows one monitor to view sequence while the other operates with a continuous scene.



Information

Switcher circuits can be much more complex than the ones shown in the examples. Circuits may involve dozens of cameras and monitors with pre-programmed sequences of scenes.

The following picture shows some typical switchers.



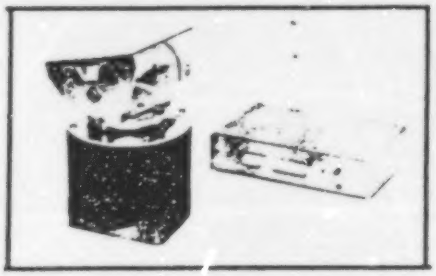
The alarm type sequential switcher is used in hospitals, security systems and industrial operations where a single operator must monitor several cameras.

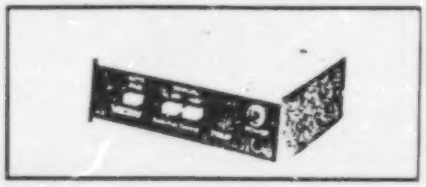
SCANNER CONTROLS

Scanners are motor driven devices that hold a camera. The scanner moves the camera in a way that takes in many fields of view. The scanner operates very much like a person that walks into a room and moves their eyes until they see everything within the room.

Scanner controls determine the nature ot the scan. If may be fast or slow or in a pre-programmed pattern.

A scanner and a scanner control unit are shown below.



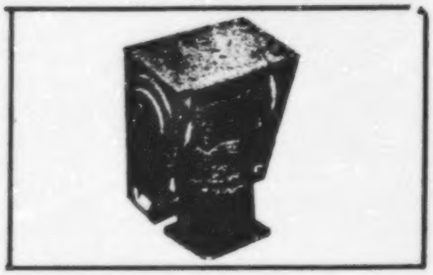


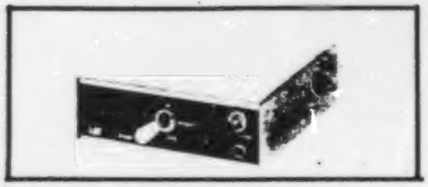
Information

PAN AND TILT CONTROLS

Pan and tilt devices are similar to scanners. Pan is a movement of the camera on the horizontal plane. Tilt is vertical movement of the camera. Pan and tilt devices are made for both outdoor and indoor use. Pan and tilt platforms hold the camera. A motor drive mechanism moves the platform in horizontal and/or vertical directions.

A control unit for the pan and tilt drive can be operated manually or automatically. A pan and tilt drive and control unit are shown in the following picture.

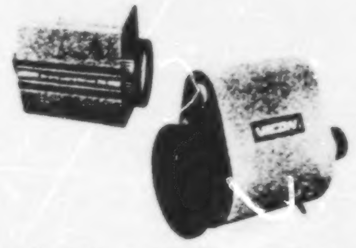




ZOOM LENS CONTROL

A zoom lens has adjustable focal length. CCTV systems use motorized zoom lenses. Zoom lenses are driven by a cable or push-rod mechanism. The focal length can be adjusted from a remote monitoring station. The zoom feature allows the monitor to change the focus of the camera through remote control.

A motorized zoom lens and a zoom lens control are shown in the following pictures.



Remotely controlled motorized, pushrod, crank-driven, cable-driven zoom lenses. Stock or custom made.

Information

VIDEO AMPLIFIERS

In some applications, long runs of coaxial cable are necessary. Long runs cause a loss in the clarity and focus of the picture. A video amplifier will help provide clear pictures on long cable runs.

TIME/DATE CHARACTER GENERATOR

An application may require a date and time display on the monitor. This can be achieved by:

- Injecting alphanumeric characters at the camera by optics
- Injecting the characters at the camera or monitor electronically.

For most applications, a time date generator at the monitor location is the best method. The generator is more cost-effective if the system uses several cameras.

Optical Time/Date/Data Generator

Assignment

- Complete the job sheet.
- Complete the self assessment and check answers.
- Complete the post assessment and have instructors check your answers.

Job Sheet

INSPECT CCTV CONTROL EQUIPMENT

- Find a place that has a variety of CCTV equipment.
- Carefully examine the following control equipment.
  - Pan and tilt platforms and controls.
  - Zoom lens controls.
  - Image splitters.
  - Switchers.
  - Scanners.
  - Video amplifiers.
- Read the manufacturers recommendations for application.
- Read the specifications for each type of equipment.
- Observe leads and connectors of each piece of equipment and how it is to be mounted, i.e. wall, desk-top, platform.

Self Assessment

1. Pictures from more than one camera can be shown on a single monitor by use of an ____________________ ____________________.

2. Scenes from several cameras can be shown in a rotational sequence by use of a ________________________.

3. When a camera is moved horizontally, it is called a _____________________.

4. Vertical movement of the camera is a _______________________.

5. A lens with an adjustable focal length is called a ______________ lens.

6. A video _________________ is used to improve focus when cable runs are long.

7. A ________________ switcher is one that causes short scenes of pictures from several cameras to appear in sequence on the monitor.

8. A ______________ moves the camera to cover an entire area in a small amount of time. In other words, it is a quick look-see of the surroundings.

9. A type of splitter that screws into the C-mount of a camera is an ________ __________ ____________.

10. Hospitals, security systems and industrial operations that use one operator to monitor many cameras use an ______________ type sequential switcher.

Self Assessment Answers

1. Image splitter or electronic splitter
2. Switcher
3. Pan
4. Tilt
5. Zoom
6. Amplifier
7. Sequential
8. Scanner
9. Image splitting optics
10. Alarm

INSTRUCTIONAL LEARNING SYSTEMS

• Post Assessment

1. What is the type of image splitter that screws into the C-mount of a camera?

2. What is a pan?

3. What is a tilt?

4. What does a switcher fo?

5. What is a zoom lens?

6. How is a zoom lens operated?

7. When should a video amplifier be added to a CCTV system?

8. Where would one be likely to find the alarm type sequential switcher being used?

9. How is a scanner used?

10. When should an electronic splitter be used instead of an image splitting optic?

Instructor Post Assessment Answers

1. Image splitting optics

2. Horizontal movement of camera

3. Vertical movement of camera

4. Switcher allows scenes from many cameras to be shown on one monitor by a rotational sequence.

5. One with adjustable focal length.

6. By cable driven motor or pushrod.

7. When the cable run is too long.

8. Hospitals, industrial operations and security systems.

9. To get a quick look at a protected area. The camera sweeps the whole area.

10. When many cameras are to be handled on one monitor.

Supplementary References

- Security Distributing and Marketing Magazine. P.O. Box 272, Culver City, CA. 90230 (Past issues have many good articles on CCTV systems.)